SCIENCE-IX

MODULE - 1

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MATTER IN OUR SURROUNDING

INTRODUCTION

All the substances around us have different shape, size and texture. Everything in universe is made up of matter. The air we breathe, the food we eat, the water we drink, the pen with which we write, the book we read, are made up of matter. In this chapter, we shall discuss the matter in our surroundings.

IMPORTANT TERMS AND CONCEPTS

1. **Material :–** The term used to describe a particular kind of matter, is called material e.g. – wood, water and marble.

Type of material :–

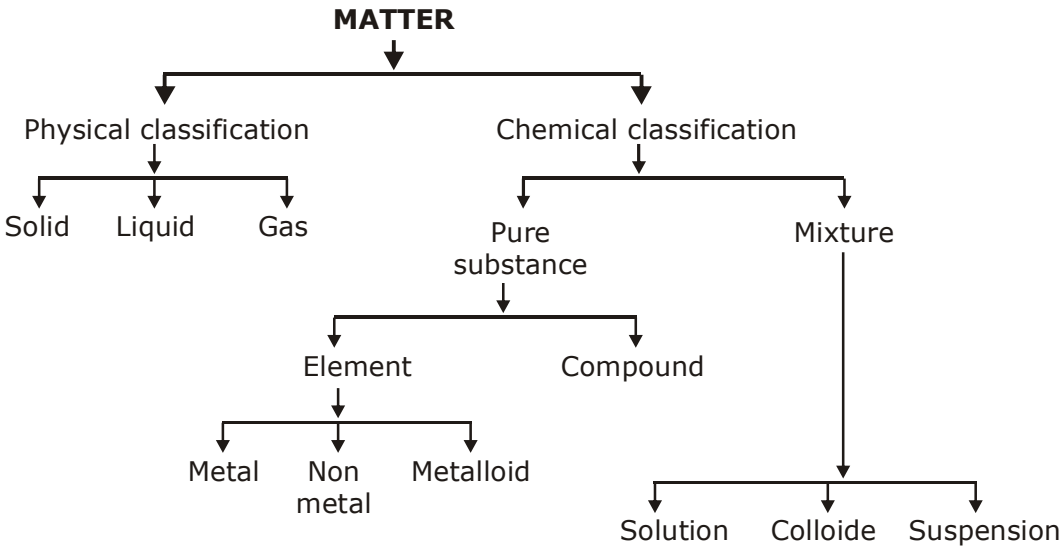
Homogeneous Material	Heterogeneous Material
Which has same composition and same properties is called. Homogeneous material.	Which has different composition and different properties in material different parts is, called heterogeneous material. For e.g.: In marble, presence of grey and red grains of other materials.

2. **Matter :** It is substance which occupies space and has mass. Air, Earth, Fire, Sky and water five basic element, "The Panch Tatva" according to the earlier Indian Philosophers. According to them everything i.e., living or non-living is made up of these five elements.

3. **Classification of Matter :** Nowadays scientists have classified matter in the following two ways :

(i) The physical classification based on physical properties of matter and

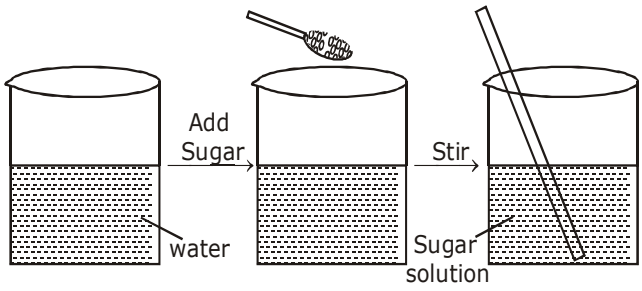
(ii) The chemical classification based on chemical composition of matter.



Classification of Matter

4. **Physical Nature of Matter :** Matter is made up small particles and there is space between particles of matter. It can be proved with the help of following experiment.

Experiment: To show that there is space between particles of matter.



Dissolution of sugar in water. In solution particles of sugar are present in the spaces between particles of water

Materials Required : 100 ml beaker, water, salt, glass rod.

Procedure :

Take a 100 ml beaker and fill it with water and mark the level of water.

Dissolve the given salt with the help of glass rod.

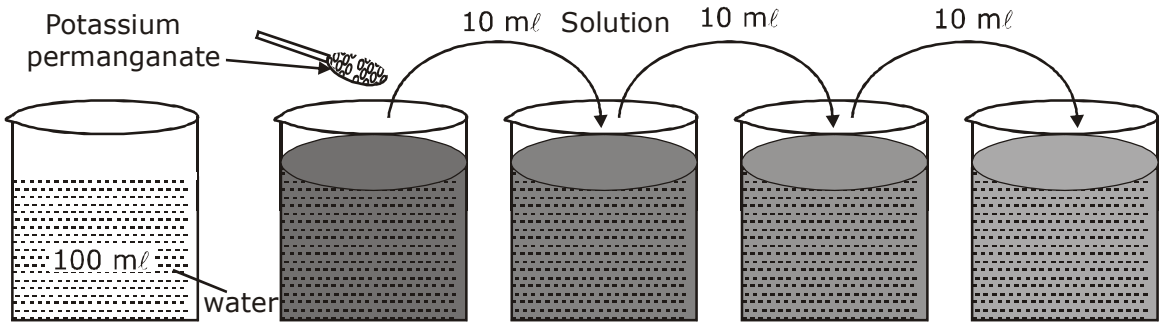
Observe the change in the water level and record your observations.

Observations : The salt gets dissolve in water. The particle of salt have entered the space between water molecules, therefore, the level of water does not change.

Conclusion : The salt consists of large number of small particle which occupy the space between molecules of water.

5. **Size of Particles of Matter :** The particles of matter are extremely small in size which cannot be seen even with powerful microscope. Their size can be observed with the help of following experiment.

Experiment : To show that matter is made up of very small particles.



Decrease in colour of potassium permanganate solution

Materials Required : Crystals of $KMnO_4$ (potassium permagnate), water, 3 separate beakers.

Procedure :

Take 2-3 crystals of $KMnO_4$ and dissolve them in 50ml of water in beaker 1.

Take 5 ml of solution from beaker 1 and put it into 50 ml of water in beaker 2 and observe the colour of solution.

Take 5ml of solution from beaker 2 and put it into 50 ml of water in beaker 3 and observe the colour of solution.

Observations : The colour of solution remains purple in all the beakers.

Conclusion : It shows that even 2-3 crystals of $KMnO_4$ consists of millions of small particle which dissolve in water giving purple colour to the solution.

6. Space between Particles of Matter : When we dissolve sugar, salt or KMnO4 in water, particles get evenly distributed in water. Similarly, when we prepare tea or coffee, the particles of one type of matter diffuse into space between particles of the other. This shows that there is enough space between particles of matter.

Swimming is possible because of space between water molecule.

7. Continuous movement of Particles :

Particles of matter are continuously moving, i.e., they possess kinetic energy which increases with increases in temperature.

Experiment : To show the particles of matter are continuously moving.

Materials Required : Incense stick or agarbati, match box.

Procedure :

Put an unlit incense stick in a corner of your class.

Go close to the incense stick to smell it.

Now light the incense stick. And try to get the smell from a distance.

Observations : The smell of unlit incense stick can be observed only by going close to it whereas the smell of lighted incense stick can be observed from a distance.

Conclusion : The particles of matter of continuously moving but the speed of particles is very slow. The speed of particles increase with the increase in temperature.

8. Diffusion : The process of intermixing of particles of two or more substance on their own is called diffusion. The rate of diffusion increases on heating that is why an incense stick gives smell only when we come close to it, but on lighting the stick we get smell even far away from it.

9. Attraction between Particles of Matter :

There is force of attraction between particles of matter. It can be explained with the help of following game in the field.

Make four groups and form human chains as follows.

The first group should hold each other from back and lock arms like Bihu dancers.

The second group should hold hands to form human chain.

The third group should from a chain by touching each other with only their finger tips.

The fourth group should run around and try to break three human chains one by one into groups as small as possible.

Observations and Conclusions

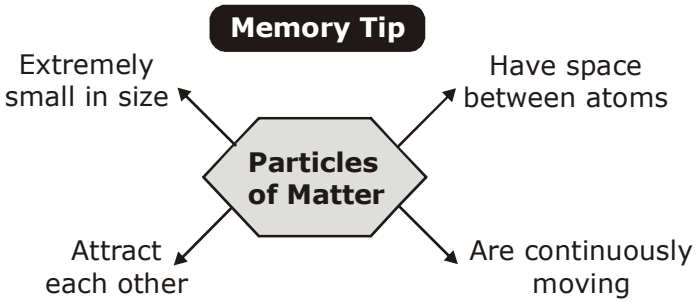
The third group is easily to break because of least force of attraction. It is similar to particles in gaseous state.

The first group is most difficult to break due to maximum force of attraction. It represents particles present in solid state.

The second group requires little force to break which shows it has force of attraction less than first group but more than third group. It represents particles in the liquid state.

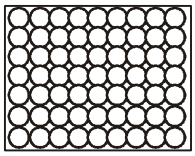
Even in solids, the force of attraction differs from one substance to another. There is maximum force of attraction between particles of iron nail, less in a piece of chalk and least in rubber band.

It is difficult to cut a stream of water with the help of fingers due to force of attraction between particle of liquids. Thus, there is force of attraction between particles of matter which keeps the particles together. The strength of forces varies in different kinds of matter.



10. **Classification of Matter on the basis of Physical State :** Matter can be classified into Solid, Liquid and Gas.

11. **Properties of the Solid State :**


Arrangement of particles in a solid

They have fixed shape.

They have fixed volume.

They are rigid an have fixed boundaries.

They are incompressible because intermolecular space is less.

They have high density as compared to other states of matter.

They have strong force of attraction between the particles.

The particles are closely packed in solid, therefore, there is less intermolecular space between the particles.

The kinetic energy of particles in solid is very less. They vibrate only at their mean position that is why solids have rigid shape.

Solid diffuse into solids to very less extent, e.g., it is difficult to rub a blackboard on which something is written in chalk without cleaning for 10-15 days.

12. **Volume :** The space occupied by a substance is called volume. Its SI unit is cubic metre (m^3). Its common unit is litre. (1L = $1dm^3$, 1L = 1000 ml, 1ml = $1cm^3$).

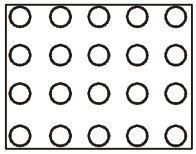
13. **Density :** The mass per unit volume of a substance is called density. Density = mass/volume. The SI unit of density is km/m^3 where common unit is g/cm^3. (CGS unit)

Density is maximum in the solid state of a substance

14. **Kinetic Energy :** The energy possessed by particles by virtue of its motion is called kinetic energy.

Internal structure of rubber in like that of spring i.e. why it is stretchaber

15. **Properties of the Liquid State :**


Arrangement of molecule in a liquid

Liquids do not have fixed shape or boundaries.

They have fixed volume.

They can flow, i.e., they have fluidity.

They have low compressibility but more than solids.

They have lower density as compared to solids.

The intermolecular forces of attraction are weaker as compared to solids.

The intermolecular space is more than that of solids.

The particles in liquid state can move freely and hence have higher kinetic energy than solids but less than that of gases.

They shows the property of intermixing and thus they can diffuse. It can be shown by the following experiment.

Experiment : To compare the rate of diffusion of liquids having different densities.

Materials Required : Two beakers filled with water, blue ink, honey.

Procedure :

Take two beakers filled with water.

Add a drop of blue ink into first beaker slowly and honey in the second beaker.

Leave them undistributed at you home or in a corner in the class.

Record you observations.

Observations :

The blue ink diffuses into water and water become light blue in colour.

Honey diffuses very slowly into water, therefore, takes lots of time to diffuse evenly.

Conclusion : Liquids with higher density, diffuse slower than liquids having lower density.

Factor Affecting Rate of Diffusion :

(i) Density : The rate of diffusion depends upon density of liquids. Higher the density, lesser will be the rate of diffusion.

(ii) Temperature : The rate of diffusion depends upon temperature, i.e, the rate of diffusion increase with an increase in temperature which can be shown experimentally.

(iii) Physical State : Solids can diffuse into liquids slowly whereas liquids can diffuse into liquids faster and gases can also diffuse into liquids.

Experiment : To study the variation of rate of diffusion with temperature of solid in liquids.

Materials Required : Copper sulphate, two beakers, cold water and hot water.

Procedure :

Take 50ml of cold water in a beaker.

Take 50ml of hot water in another beaker.

Add a crystal of copper sulphate into the beaker containing 50ml of cold water.

Add a crystal of copper sulphate into the beaker containing 50ml of hot water.

Leave them undisturbed.

Record the observations.

Observations : The colour of solutio in first beaker becomes blue slowly whereas the colour becomes blue faster in second beaker.

Conclusion : The rate of diffusion increases with increase in temperature because kinetic energy of molecules increases.

16. **Diffusion of Gases in Liquids :** Gases can also diffuse in liquids. Oxygen and carbon dioxide get dissolved in water which is essential for growth of aquatic plants and animals.

17. **Properties of Gaseous State :**

Gases do not have fixed shape, i.e., they take the shape of container.

They do not have fixed volume, therefore no definite boundaries.

They can flow in all directions, hence gases also show fluidity.

They are highly compressible.

They have lower densities as compared to liquids and solids.

They have higher kinetic energy as compared to liquids and solids.

The rate of diffusion is fastest in gases.

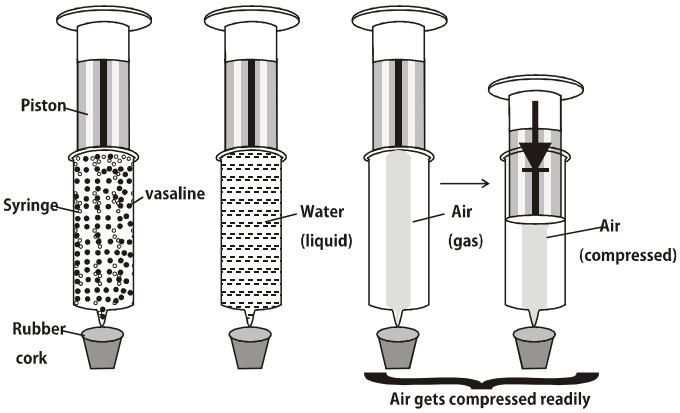
There is weak intermolecular force of attraction.

There is large intermolecular space, therefore, gases can be easily compressed.

Gases can be compressed more easily than liquids which can be shown by following experiment.

Experiment : To show that gases can be compressed more easily than liquids.

Material Required : Two 10ml syringes, rubber cork, vaseline.



Study the compressibility of solid, liquid and gas.

L.P.G is obtained by compresing petroleum gas into cylinder Its major constitual is butane C_4H_{10}.

Procedure :

Take two 10ml syringes and close their nozzle by inserting them in a rubber cork as shown in figure.

Remove the piston from both the syringes.

Allow the air to fill the space inside one syringe and fill water in the other.

Insert type pistons back into syringes.

Apply some vaseline on the piston fro smooth movement.

Now try to compress by pushing piston in the syringe.

Record your observations.

Observations : In case or air, piston is easily pushed in as compared to syringe filled with water.

Conclusion : The bases can be compressed more easily than liquids. It is because there are weak intermolecular forces of attraction between particles, so the distance between the particles in gaseous state is very large as compared to solids and liquids, e.g., CNG is compressed natural gas which is being used in vehicles. LPG is liquified petroleum gas which is used for cooking.

18. **Pressure** : It is defined as force exerted per unit area, e.g., gases exert pressure on the walls of the containing. The kinetic energy of the particles in gaseous state i maximum. The particles are in state of constant random motion therefore, they collide with themselves as well as with the walls of the container and exert pressure.

19. **Change of state :** The state of substance depends upon temperature and pressure, e.g., water exists as solid at 0ºC, as liquid at room temperature whereas in gaseous state at 100ºC. The state of matter will change with change in temperature which is shown by following experiment.

Change in State of Water

Ice	heat ⇀ ↽ cool	Water	heat ⇀ ↽ cool	Steam
Solid		(liquid)		(gas)

Experiment : To study the effect of temperature on solids and liquids.

Materials Required : Ice, thermometer, beaker.

Procedure :

Take about 50g of ice in a beaker and hang a laboratory thermometer in it so that bulb is in contact with ice.

Start heating the beaker at low flame.

Now down the temperature when ice starting melting.

Note the temperature when all the ice has converted into water.

Record your observations for conversion of solid into liquid state.

Now put a glass rod in the beaker and heat while constant stirring till the water starts boiling.

Keep a close look at the thermometer reading till most of the water has vapourised.

Record your observations for the conversion of ice into liquid water and then into vapour state.

Observations and Conclusion : When temperature of solid is increased, the kinetic energy of particles increases. Due to increase in kinetic energy, the particle starts vibrating at a greater speed and overcome intermolecular forces of attraction. A stage is reached when intermolecular forces become so less that it changes into liquid. When temperature is further increased, a state comes when liquid changes into vapour.

20. **Melting Point :** The temperature at which solid changes into liquid completely is called melting point. Melting point of solids gives indication of the strength of intermolecular forces of attraction. Higher the melting point, more will be intermolecular forces of attraction.

21. **Melting :** The process in which solid changes into liquid is called melting. It is also called fusion.

22. **Kelvin :** It is SI unit of temperature. 0ºC = 273.16 K.

If we want to change K into ºC, subtract 273.16 from the temperature given in Kelvin. For converting ºC to Kelvin (K), add 273.16 (For convenience we take 0ºC = 273K)

23. **Latent heat of fusion :** The amount of energy that is required to change 1kg of a solid into liquid at atmospheric pressure without any change of temperature at its melting point is called latent heat of fusion.

24. **Boiling Point :** The temperature at which a liquid changes into gas or vapour is known as boiling point. It also indicates strength of intermolecular force of attractions. Greater then intermolecular forces of attractions, higher will be the boiling point. The boiling point of water is 100ºC (373K).

25. **Boiling :** The process of converting liquid into vapour is called boiling. It is bulk phenomenon, i.e, particles from inside the liquid gain enough energy to change into vapour state. It takes place only at boiling point.

26. **Latent Heat of Vapourisation :** The amount of energy that is required to change 1kg of liquid into vapours at atmospheric pressure without any change in temperature at its boiling point is called latent heat of vapourisation.

27. **Gas :** It is stable state as compared to vapours, e.g., O_2, N_2, H_2, CO_2, etc.

28. **Vapour :** It is unstable state. On cooling, vapours change into liquid state. The work 'vapour' is used to describe those gases which usually exist as liquid at room temperature.

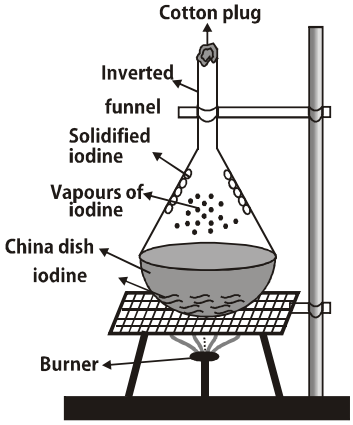
29. **Vapourisation :** It is process in which liquid changes into vapour. It is a surface phenomenon. It takes place at all temperatures. It is a slow process and its rate increase with increase in temperature.

30. **Volatile Liquids :** Those liquids which can change into vapours easily are called volatile liquids, e.g., petrol, alcohol, acetone, ether, etc. evaporate easily because they have low boiling points due to weak intermolecular forces of attraction. Water has high boiling point due to strong intermolecular forces of attraction.

31. **Sublimation :** It is a process in which solid directly changes into vapours without changing into liquid state, e.g., camphor, I_2, NH_4Cl, naphthalene can sublime. It can be shown experimentally.

Experiment : To show the process of sublimation experimentally.

Materials Required : Solid iodine, funnel, tripod stands, china dish, wire gauze, burner or spirit lamp, cotton.



Sublimation process

Procedure :

Take 2g of iodine in china dish.

Put an inverted funnel over it whose stem is closed by cotton plug and set the apparatus as shown in diagram.

Heat and china dish so that vapours are formed and record the observations.

The vapours of iodine get condensed on the walls of the funnel.

Observations : The violet coloured vapours of iodine get condensed and change into solid iodine.

Conclusion : Iodine can sublime and can be purified by sublimation.

32. **Effect of Pressure on Change in State :** When we apply pressure and compress the gas, intermolecular force of attraction increases and molecules come close to each other. It may be change into liquid depending upon temperature and nature of the gas.

33. **Liquidification of Gases :** Gases can be liquified at low temperature and high pressure, e.g., H_2, N_2 and O_2 can be liquified at low temperature at high pressure. NH_3 can be liquified at room temperature. CO_2 can be solidified at low temperature and high pressure. Solid CO_2 is also called dry ice.

Evaporation		Boiling (Vaporisation)	
1	It takes place spontaneously at all temperature.	1	It takes place at definite temperature i.e. at B.P.
2	It is a surface phenomenone.	2	It is a bulk phenomenone.
3	It always cause cooling.	3	No colling.

34. **Atmosphere (atm) :** It is unit of measuring pressure exerted by a gas. The pressure of air in atmosphere is called atmospheric pressure.

35. **Pascal (Pa) :** It is unit of measuring pressure exerted by a gas. The pressure of air in atmosphere is called atmospheric pressure.

1 atm = 1.01×10^5 Pa

The atmospheric pressure at seal level is 1 atmosphere and is taken as normal atmospheric pressure. As we go higher, atmospheric pressure decreases.

36. **Evaporation :** It is a process in which liquid changes into vapours e.g., water changes into vapours if left uncovered. Wet clothes dry up because water gets evaporated. The particles of water collide with each as well as with particles of gases in atmosphere. After some time, the particles on the surface gain sufficient energy so as to change into vapours. It is a surface phenomenon.

37. **Factor Affecting evaporation :**

(a) Surface area : Greater the surface area, more will be the rate of evaporation because it is a surface phenomenon. There will be more number of molecules on the surface which will change into vapour easily.

(b) Humidity : It is amount of water vapours present in air. The air around us cannot hold more than a definite amount of water vapours at a given temperature. If the amount of water in air is already of water is air is already high, the rate of evaporation decreases. Decrease in humidity leads to increase in rate of evaporation.

(c) Temperature : The rate of evaporation increases with increase in temperature because more number of particles gain enough kinetic energy to go to vapour state.

(d) Wind speed : The rate of evaporation increase with increase in wind speed because particles of water vapours are taken away decreasing the amount of water vapours in atmosphere.

38. **Effect of Evaporation :** Evoparation leads to cooling because high energy molecules leave the surface and average energy of remaining molecules decreases, which results in drop in temperature of the part of liquid that is left. Therefore, evaporation cause cooling.

Evaporation causes cooling:–

During evaporation, cooling is always caused. This is because evaporation is a phenomenon in which only the high energy particles leave the liquid surface. As a result, the particles having low energy are left behind. Therefore, the average molecular energy of the remaining particles left in the liquid state is lowered. As a result, there is decrease in temperature on the part of the liquid that is left. Thus evaporation causes cooling.

Example:– **(i)** When we pour some acetone on our palm, we feel cold. This is because the particles gain energy from our palm or surroundings and leave the palm feeling cool.

(ii) We sprinkle water on the root or open ground after a sunny hot day. This cools the roof or open ground. This is because the large latent heat of vaporization of water helps to cool the hot surface.

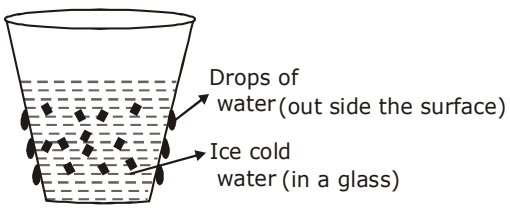
Some other examples of evaporation:–

(i) We should wear cotton clothes in hot summer days to keep cool and comfortable.

This can be explained as follows. We get a lot of sweat on our body in hot summer days. Cotton is a good absorber of water, so it absorbs the sweat from our body and exposes it to the air for evaporation. The evaporation of this sweat cools our body. The synthetic clothes (made of polyester etc) do not absorb much of sweat, so they fail to keep our body cool in summer.

(ii) We see water droplets on the outer surface of a glass containing ice-cold water.

Take some ice-cold water in a glass. Soon we will see water droplets on the outer surface of the glass. The water vapour present in air, on coming in contact with the cold glass of water loses energy and gets converted to liquid state, which we see as water droplets.



Droplets formed on the surface of the glass containing ice cold water

(iii) Water keeps cool in the earthen pot (matki) during summer:–

When the water oozes out of the pores of an earthen pot, during hot summer, it evaporates rapidly. As the cooling is caused by evaporation, therefore, the temperature of water within the pot falls and hence it becomes cool.

(iv) Rapid cooling of hot tea:–

If tea is too hot to sip, we pour it in the saucer. In doing so, we increase the surface area and the rate of evaporation. This, in turn, causes cooling and the tea attains a desired temperature for sipping

(v) A wet handkerchief is placed on the fore head of a person suffering from high fever. The logic behind placing wet cloth is that as the water from the wet cloth evaporates, it takes heat from the skull and the brain within it. This, in turn, lowers the temperature of brain and protects it from any damage due to high temperature.

(vi) We often sprinkle water on the road in summer. The water evaporates rapidly from the hot surface of the road, there by taking heat away from it. Thus, the road becomes cool.

39. **Effect of Temperature on Clothes :** Cotton is good absorber of water, helps in absorption of sweat and exposing it to atmosphere for easy evaporation during summers. It causes cooling of our body.

40. **Plasma :** It is fourth state of matter. It consists of super energetic and super excited particles which are in the form of ionised gases. The fluorescent tube, neon sign bulbs consist of plasma. Inside the neon bulb, there is neon gas whereas inside the fluorescent tube, there is helium gas or some other gas. The gas gets ionised, i.e., gets charged when electrical energy flows through it. This charging up creates glowing plasma inside the tube or bulb. The plasma glows with a special colour depending upon the nature of the gas. The sun and stars glow because of presence of plasma in them. The plasma is created in stars due to very high temperature.

Irving Langmuir assigned the term plasma in 1928

41. Bose-Einstein Condensate (B.E.C.) is fifth state of matter which is formed from matter that has been cooled to near absolute zero (–273ºC). When a group of atoms is cooled to a very low temperature, the velocity decreases because they have very low energies. This causes the individual atoms to overlap each other forming a single super atom with all of its constituting atoms sharing a single energy state.

Bose and A.Einstein

A rotating B.E.C. could be used as model black hole, allowing light to enter but not to escape. Condensate can also be used to 'free' pulses of light, to be released again when condensate break down. Research in this field is going on.

1. **Matter**

(i) Anything which occupies space and has mass is called matter.

(ii) Food, water, air, clothes, table, chair, plants and trees.

(iii) Indian philosophers said that all the matter living or non-living, was made up of five basic elements air, earth, fire, sky and water

(iv) On the basis of its physical properties and on the basis of its chemical properties.

(v) On the basis of chemical properties the matter is classified as **elements, compounds** and **mixtures**.

(vi) Everything around us is made of tiny pieces or particles. The particles make up matter are atoms or molecules.

❑ **Characteristics of particles of matter :**

(i) The particles of matter are very, very small

(ii) The particles of matter have spaces between them

(iii) The particles of matter are constantly moving

(iv) The particles of matter attract each other

❑ **Classification of matter**

On the basis of physical states, all the matter can be classified into three groups.

1. Solids 2. liquids 3. Gases

❑ **Properties of solids**

(i) Solids have a fixed shape and a fixed volume

(ii) Solids cannot be compressed much.

(iii) Solids have high densities. They are heavy

(iv) Solids do not fill their container completely.

(iv Solids do not flow.

Ex. Ice, wood, coal, stone, iron, brick

❑ **Properties of liquid**

(i) Liquids have a fixed volume but they have no fixed shape. Liquids take the shape of the vessel in which they are placed.

(ii) Like solids, liquids cannot be compressed much.

(iii) Liquids have moderate to high densities. They are usually less dense than solids.

(iv) Liquids do not fill their container completely.

(v) Liquids generally flow easily.

Ex. Water, milk, fruit juice, ink, groundnut oil, kerosene etc.

❑ **Properties of gases**

(1) Gases have neither a fixed shape nor a fixed volume. Gases acquire the shape and volume of the vessel in which they are kept.

(2) Gases can be compressed easily.

(3) Gases have very low densities. They are very light.

(4) Gases fill their container completely.

(5) Gases flow easily.

Ex. Air, oxygen, hydrogen, nitrogen

❑ **Comparison of characteristic properties of solids, liquids and gases**

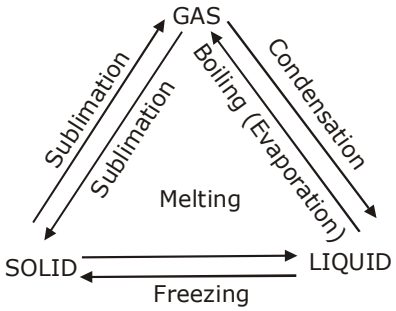
	Property	Solids	Liquids	Gases
1	**Shape**	Definite	Take the shape of the container, but do not necessarily occupy all of it.	Take the shape of the container by occupying whole of the space available to them.
2	**Volume**	Definite	Definite	Take the volume of the container.
3	**Compressibility**	Almost nil	Almost nil	Very large
4	**Fluidity or Rigidity**	Rigid	Fluid	Fluid
5	**Density**	Large	Large	Very small
6	**Diffusion**	Generally do not diffuse	Diffuse slowly	Diffuse rapidly
7	**Free surfaces**	Any number of free surfaces	Only one free surface	No free surface.

2. Change of state of matter : –

(i) A substance may exist in any of the three states of matter (i.e. solid, liquid or gas) depending upon the conditions of temperature and pressure.

(ii) By changing the conditions of temperature and pressure, a substance can be made to exist as solid, liquid or a gas.

(iii) A solid on heating usually changes into a liquid which on further heating changes into gas. Similarly, a gas on cooling condenses into a liquid which on further cooling changes into a solid.



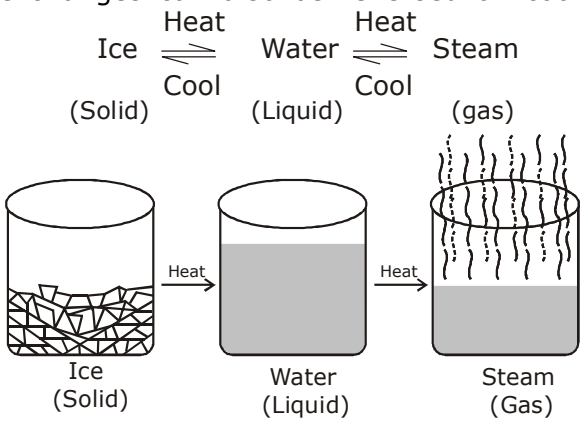
The most familiar and common example is water. It exists in all the three states**:**

(a) Solid **:** ice

(b) Liquid **:** water and

(c) Gas **:** water vapour.

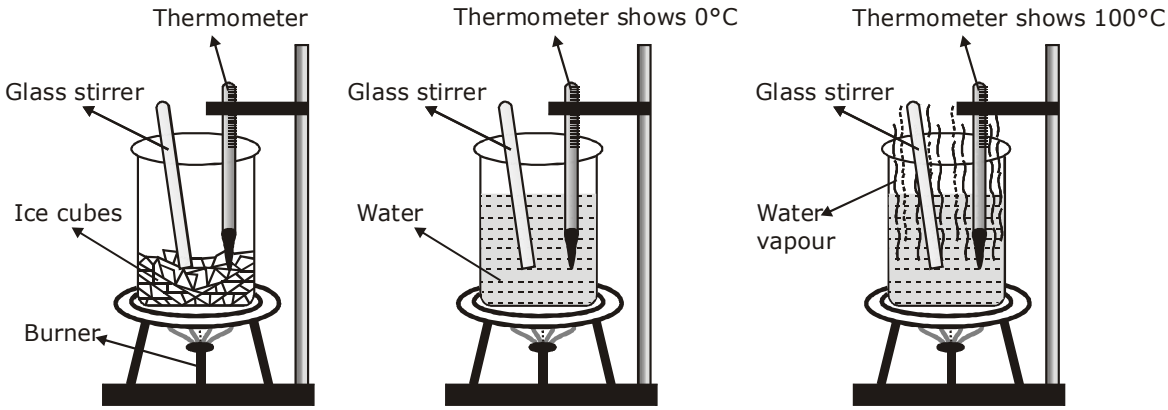
Ice is a solid state and may be melted to form water (Liquid) which on further heating changes into steam (gas). These changes can also be reversed on cooling.



Change in three states of matter

3. Effect of temperature change

By increasing the temperature (by heating), a solid can be converted into liquid state; and the liquid can be converted into gaseous state (or vapour state). And by decreasing the temperature (by cooling), a gas can be converted into liquid state; and a liquid can be converted into solid state.



Conversion of ice to water and water to water vapour

❑ **Solid to liquid change : Melting**

(i) Definition : The process in which a solid substance changes into a liquid on heating, is called melting (or fusion).

(ii) Melting point : The temperature at which a solid substance melts and changes into a liquid at atmospheric pressure, is called melting point of the substance.

(iii) Ice is a solid. In solids, the particles are tightly packed together. When we heat a solid, its particles become more energetic and kinetic energy of the particles increases. Due to the increase in kinetic energy, the particles start vibrating more strongly with greater speed. The energy supplied by heat overcomes the intermolecular forces of attraction between the particles. As a result, the particles leave their mean position and break away from each other. When this happens, the solid melts and a liquid is formed.

Ex. Melting point of ice = 0ºC
Melting point of wax = 63ºC
Melting point of iron = 1535ºC

The melting point of a solid is a measure of the force of attraction between its particles. Higher the melting point of a solid substance, greater will be the force of attraction between its particles.

Liquid to gas change : Boiling (or vaporisation)

(i) Definition : The process in which a liquid substance changes into a gas rapidly on heating, is called boiling.

(ii) Boiling point : The temperature at which a liquid boils and changes rapidly into a gas at atmospheric pressure, is called boiling point of the liquid.

(iii) In a liquid most of the particles are close together. When we supply heat energy to the liquid, the particles of water start vibrating even faster. Some of the particles become so energetic that they can overcome the attractive forces of the particles around them. Therefore, they become free to move and escape from the liquid. When this happens, the liquid evaporates i.e., starts changing into gas.

Ex. Boiling point of water = 100ºC
Boiling point of alcohol = 78ºC
Boiling point of mercury = 357ºC

Remember
Impurities decreases the F.P. and increase B.P. of liquids.

The boiling point of a liquid is a measure of the force of attraction between its particles. Higher the boiling point of a liquid, greater will be the force of attraction between its particles.

When a liquid is heated, the heat energy makes its particles move even faster. At the boiling point the particles of a liquid have sufficient kinetic energy to overcome the forces of attraction holding them together and separate into individual particles. And the liquid boils to form a gas.

Gas to liquid change : Condensation

The process of changing a gas to a liquid by cooling, is called condensation. Condensation is the reverse of boiling.

Remember
Condensation is opposite to evaporation

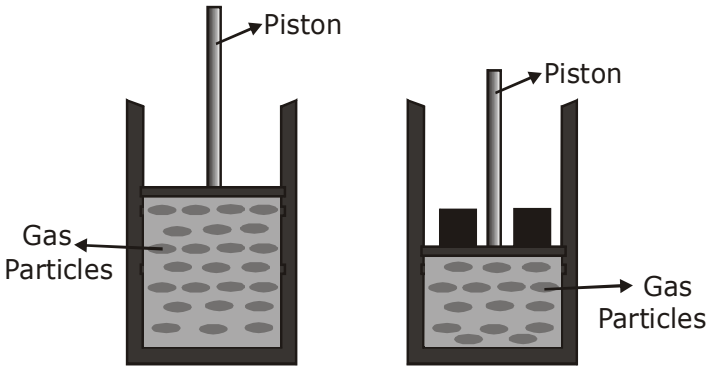
Liquid to solid change : Freezing

The process of changing a liquid into a solid by cooling, is called freezing. Freezing means solidification. Freezing is the reverse of melting. So, the freezing point of a liquid is the same as the melting point of its solid form.

Remember
Freezing is opposite to melting

Ex. Melting point of ice = 0ºC
Freezing poing of water = 0ºC

4. Effect of change of pressure



By applying pressure particles of matter can be brought close together

(i) The three states of matter differ in the intermolecular forces and intermolecular distances between the constituent particles.

(ii) Gases are compressible because on applying pressure, the space between the gaseous particles decreases. Therefore, gases can be compressed readily.

(iii) When we apply pressure and reduce temperature the gases can be converted into liquids i.e., gases will be liquefied.

(iv) The process of conversion of a gas into a liquid by increasing pressure or decreasing temperature is called **liquidification.**

A substance may exist in any of the three different states of matter depending upon the conditions of temperature and pressure.

(1) If the melting point of a substance is above the room temperature at the atmospheric pressure, it is said to be a solid.

(2) If the boiling point of a substance is above room temperature under atmospheric pressure, it is classified as liquid.

(3) If the boiling point of the substance is below the room temperature at the atmospheric pressure, it is called a gas.

5. Latent heat

(i) **Definition :** The heat energy which has to be supplied to change the state of a substance is called its latent heat.

(ii) Latent heat does not raise the temperature but latent heat has always to be supplied to change the state of a substance. The word 'latent' means 'hidden'

(iii) Every substance has some forces of attraction between its particles which hold them together. Now, if a substance has to change its state, then it is necessary to break these forces of attraction between its particles. The latent heat does not increase the kinetic energy of the particles of the substance, the temperature of a substance does not rise during the change of state.

Latent heat is of two types

(i) **Latent heat of fusion :** The heat required to convert a solid into the liquid state is called latent heat of fusion. In other words 'The latent heat of fusion of a solid is the quantity of heat in joules required to convert 1 kilogram of the solid to liquid, with out any change in temperature.

Ex.16 The latent heat of fusion of ice = 3.34×10^5 J/kg

(i) **Latent heat of vaporisation :** The heat required to convert a liquid into the vapour state is called latent heat of vaporisation.

(ii) The other words 'The latent heat of vaporisation of a liquid is the quantity of heat in joules required to convert 1 kilogram of the liquid to vapour or gas, without any change in temperature.

Ex. Latent heat of vaporisation of water

$= 22.5 \times 10^5$ J/kg

6. Sublimation

(i) **Definition :** The changing of a solid directly into vapours on heating, and of vapours into solid on cooling, is known as sublimation.

(ii) Sublimation can be represented as:

$$\text{Solid} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} \text{Vapour (or Gas)}$$

(iii) The solid substance which undergoes sublimation is said to 'sublime'. the solid obtained by cooling the vapours of the solid is called a 'sublimate'.

Ex. When solid ammonium chloride is heated, it directly changes into ammonium chloride vapour. And when hot Ammonium chloride vapour is cooled, it directly changes into solid ammonium chloride. Ammonium chloride, Iodine, Camphor, Naphthalene and Anthracene.

7. Evaporation

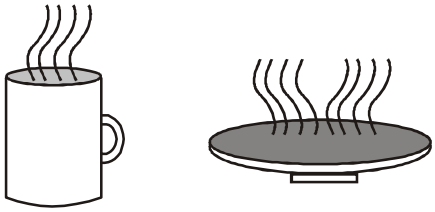
(i) **Definition :** The process of change of a liquid into vapour at any temperature below its boiling point is called evaporation.

Factors affecting evaporation : –

(i) **Temperature :** Rate of evaporation increase with increase in temperature. This is because with the increase in temperature more number of particles get enough kinetic energy to go into the vapour state.

Ex. Drying of clothes take place rapidly in summer than in winter

(ii) **Surface Area :** The rate of evaporation increases on increasing the surface area of the liquid



Increase in surface area increases rate of evaporation.

Ex. If the same liquid is kept in a test tube and in a china dish, then the liquid kept in the china dish will evaporate more rapidly : Because more of its surface area is exposed to air.

(iii) **Humidity :** Humidity is the amount of water vapour present in air. Air around us cannot hold more than a definite quantity of water vapour at a given temperature. If the amount of water in air is already large i.e., humidity is more, the rate of evaporation decreases. Thus, the rate of evaporation increases with decrease in humidity in the atmosphere.

Ex. Clothes do not dry easily during rainy season because rate of evaporation less due to humidity.

(iv) Wind speed : The rate of evaporation also increases with increase in speed of the wind. This is because with increase in speed of wind, the particles of water vapour move away with wind resulting decrease in the amount of vapour in the atmosphere.

Ex. Clothes dry faster on a windy day.

8. Diffusion

(i) Definition : The spreading out and mixing of a substance with another substance due to the motion of its particles is called diffusion.

(ii) Diffusion is a property of matter which is based on the motion of its particles.

(iii) Diffusion is fastest in gases because the particles in gases move very rapidly. The diffusion is slowest in solids because the particles in solids do not move much.

(iv) The rate of diffusion increases on increasing the temperature of the diffusing substance. This is because when the temperature of a substance is increased by heating, its particles gain kinetic energy and move more rapidly and this increase in the speed of the particles of a substance increases the rate of diffusion.

Diffusion in gases

Diffusion in gases is very fast. This is because the particles in gases move very quickly in all directions.

Ex. When we light an incense stick (agarbatti) in a corner of our room, its fragrance spreads in the whole room very quickly. The fragrance of burning incense stick spreads all around due to the diffusion of its smoke into the air.

Ex. When someone opens a bottle of perfume in one corner of a room, its smell spreads in the whole room quickly. The smell of perfume spreads due to the diffusion of perfume vapours into air.

Diffusion in liquids

Diffusion in liquids is slower than that in gases. This is because the particles in liquids move slower as compared to the particles in gases.

Ex. The spreading of purple colour of potassium permanganate into water, on its own, is due to the diffusion of potassium permanaganate particles into water

Ex. The spreading of blue colour of copper sulphate into water, on its own, is due to the diffusion of copper sulphate particles into water.

The rate of diffustion in liquids is much faster than that in solids because the patricles in a liquid move much more freely, and have greater spaces between them as compared to particles in the solids.

Diffusion in solids

Diffusion in solids in a very, very slow process.

Ex. If we write something on a blackboard and leave it uncleaned for a considerable period of time we will find that it becomes quite difficult to clean the blackboard afterwards. This is due to the fact that some of the a particles of chalk have diffused into the surface of blackboard.

Ex. If two metal blocks are bound together tightly and kept undisturbed for a few years, then the particles of one metal are found to have diffused into the other metal.

IMPORTANT DEFINITIONS

1. **Melting or Fusion :** The process due to which a solid changes into liquid state at constant temperature, by absorbing heat energy, is known as **melting** or **fusion.**

2. **Freezing or Solidification :** The process due to which a liquid changes into solid state at constant temperature, by giving out heat energy, is known as **freezing** or **solidification.**

3. **Melting point :** The constant temperature at which a solid changes into liquid state by absorbing heat energy, is called **melting point.**

4. **Freezing point :** The constant temperature at which a liquid changes into solid state by giving out heat energy, is called **freezing point.**

Note : The numerical value of melting point and freezing point is the same. For example, if melting point of ice is 0°C (273 K), then the freezing point of water is 0°C (273 K).

(a) Liquid to gas change (Boiling or vaporizations) :–

In a liquid most of the particles are close together. When we supply heat energy to the liquid, the particles of water start vibrating even faster. Some of the particles become so energetic that they can overcome the attractive forces of the particles around them. Therefore, they become free to move and escape from the liquid. Thus the liquid evaporates i.e., starts changing into gas.

"The temperature at which a liquid changes into a gas or vapour at the atmospheric pressure is called its boiling point".

"Boiling" is a bulk phenomenon.

Example – *For water, the boiling point is 100°C or 373 K. The particles in steam i.e., water vapour at 373 K have more energy than water at the same temperature.*

Reason :– *This is because the particle in steam have absorbed extra energy in the form of latent heat of vaporization.*

(b) Latent heat of vaporization :– The latent heat of vaporization of a liquid is the quantity of heat in joules required to convert 1 kilogram of the liquid (at its boiling point) to vapour or gas, without any change in temperature. The latent heat of vaporization of water is **22.5×10^5 joules per kilogram(or 22.5×10^5 J/kg).**

IMPORTANT POINTS

Density :– The mass of a substance per unit of volume.

Formula – $\boxed{\text{density} = \frac{\text{mass}}{\text{volume}} = \frac{\text{kg}}{\text{m}^3}}$ or kgm^{-3}

In SI unit it is measured in kgm^{-3}

Volume :– All solids occupy a fixed volume the shape occupied by a substance is called volume. The unit of volume is m^3 (cubic meter). The common unit of volume is litre. (L)

$1m^3 = 1000\ dm^3 = 1000\ L$

$1\ L = 1\ dm^3$

$1\ L = 1000\ ml = 1000\ cm^3$

Note: –

Pressure :– In the gaseous state the particle move about randomly at high speed. Due to their random movement, the particles hit each other and also the walls of the container. The pressure exerted by the gas is because of this force exerted by gas particles per unit area on the walls of the container. The atmospheric pressure at sea level is 1 atm, and is taken as the normal atmospheric pressure.

$\boxed{P = \frac{F}{A}}$ P = Pressure, F = Force, A = Area

It is measured in "pascals" (Pa) in SI units and other unit is atm. these two units are related as–

$1\ atm = 1.01 \times 10^5\ Pa$

$1\ bar = 1 \times 10^5\ Pa$

1 bar = 1.01 atm.

Quantity	Unit	Symbol
Mass	Kilogram	Kg
Length	Meter	m
Temperature	Kelvin	K
Weight/force	Newton	N
Volume	Cubic meter	m^3
Density	Kilogram/Cubic meter	Kg/m^3
Pressure	Pascal	Pa

Some Important Relations
1Kg = 1000g
1m = 100 cm
$1m^3 = 10^6\ cm^3$ or 10^3 L (litre)
$10^3 cm^3 = 1L$

SOLVED PROBLEMS

Ex.1 What do you observe when force is applied and then removed on the plunger of the syringe containing air ? Give a reason for your answer.

Sol. The plunger moves downward on the application of force to a considerable length. When the force is removed, the plunger moves backward and takes its original position.

Ex.2 Give reasons :

(a) A gas fills completely the vessel, in which it is kept.

(b) A gas exerts pressure on the walls of the container.

(c) A wooden table should be called a solid.

(d) We can easily move our hand in air, but to do the same through a solid block of wood, we need a karate expert.

Sol. (a) The molecules of a gas have large intermolecular spaces and kinetic energy, but extermely small intermolecular forces. Thus, the molecules of the gas spread in the entire space of the containing vessel on account of high kinetic energy and practically to intermolecular forces, hence fill entire space of the vessel.

(b) The molecules of a gas have very large kinetic energy. When these molecules strike against the walls of containing vessel, they exert certain average force per unit area. As the force per unit area is known as pressure, therefore, the gases exert pressure on the sides of the containing vessel.

(c) Solids are rigid, incompressible and have definite shape and volume. Since the table has all the above mentioned properties, therefore, it it solid.

(d) The intermolecular forces between the molecules of a gas are almost negligible and intermolecular spaces are very large. Thus, we can easily move our hand in air, without any appreciable force.

The intermolecular forces between the molecules of a solid are very large and intermolecular spaces are very small. Thus, a lot of force is required to separate the molecules of a solid. It is for the same reasons that we need karate expert to break a block of wood.

Ex.3 The mass per unit volume of a substance is called density. (Density = Mass / Volume). Arrange the following in the order of increasing density :

air, exhaust from chimneys, honey, water, chalk, cotton and iron.

Sol. Exhaust from chimneys, air, cotton, water, honey and iron.

e.g..

(i) CNG (compressed Natural gas) is used as fuel in internal combustion engines.

(ii) Oxygen in compressed form is supplied to hospitals for serious patients in cylinders.

(iii) LPG (Liquefied petroleum gas) which is used in home for cooking.

(iv) The gases exhibit the property of diffusing very fast into other gases.

Ex.4 We can easily move our hand in the air but to do the same through a solid block of wood we need a karate expert.

Sol. In air the interparticle attractive forces are negligible and hence, it is easy to separate the particles in air and we can easily move our hand through it. In a solid block of wood, the interparticle forces are very strong and hence, it is not easy to separate the particles. Therefore it is not easy to move our hand through a solid block of wood (only a karate expert can do it). Dut to this property large volume of a gas

can be compressed into a small cylinder and transported easily.

Ex.5 Arrange the following substances in increasing order of forces of attraction between the particles -water, sugar, oxygen.

Sol. Oxygen < water < Sugar

Ex.6 The diver is able to cut through water in a swimming pool.

Sol. **Explanation** :– The diver is able to cut through water in the swimming pool because matter is not continuous, but it is made up of particles which have vacant spaces between them moreover, the attractive forces between molecules of water are not very strong. The diver can easily cut through water by applying force to displace water and occupy its place.

Ex.7 Why ice floats on water?

Sol. Solids generally have higher density than the liquids but ice due to its specific structure has larger interparticle spaces and hence has lower density than liquid water. As a result ice floats on water.

Temperature and pressure are the two factors which decide whether a given substance would be in a solid, liquid or gaseous state.

Ex.8 Convert the following temperatures to the celsius scale.

(a) 300 K (b) 573 K

Sol. (a) (300 – 273) = 27°C. Temperature in °C = Temperature in K – 273

(b) (573 – 273) = 300°C. Temperature in °C = Temperature in K – 273

Ex.9 Convert the following temperature to the Kelvin scale.

(a) 25°C (b) 373°C

Sol. (a) 25 + 273 = 298 K (b) 373 + 273 = 646 K

Ex.10 What is the physical state of water at –

(a) 25°C (b) 0°C (c) 100°C

Sol. (a) 25°C – Water is in liquid state.

(b) 0°C – Water is in solid state.

(c) 100°C – Water is in gaseous state.

NCERT QUESTIONS WITH SOLUTIONS

Q.1 Convert the following temperature to the Celsius scale-
(i) 293 K (ii) 410 K
Ans. (i) 293 – 273 = 20°C
(ii) 470 – 273 = 197°C

Q.2 Convert the following temperature to the kelvin scale.
(i) 25°C (ii) 373°C
Ans. (i) 25 + 273 = 298K
(ii) 373 + 273 = 646K

Q.3 Arrange the following substances in the increasing order of forces of attraction between the particles water, sugar and oxygen.
Ans. Oxygen, water and sugar.

Q.5 What is the physical state of water at
(a) 25°C (b) 0°C (c) 100°C?
Ans. (a) At 25°C, water is in liquid state.
(b) At 0°C, water is in solid state, provided heat is removed from it.
(c) At 100°C, water is in gaseous state, provided heat is supplied to it.

Q.6 Give two reasons to justify –
(a) Water at room temperature is a liquid.
(b) An iron almirah is solid at room temperature.
Sol. (a)
(i) Intermolecular forces are less.
(ii) Intermolecular spaces and kinetic energy is more.
Thus, the molecule of water can interchange their spaces and hence water is in liquid state at room temperature.
(b)
(i) Intermolecular forces are very large.
(ii) Intermolecular spaces, as well as, kinetic energy are very small.

Q.7 Ice is at 273 K more effective in cooling, than water at the same temperature, why?
Sol. One kilogram of ice at 273 K, needs 3, 36000 J of heat energy in order to form water at 273 K. As the ice can extract out large amount of heat energy on melting to form water at the same temperature, therefore, it is more effective in cooling.

Q.8 What produces more severe burns, boiling water or steam?
Sol. Steam will produce more severe burns than boiling water. It is because, 1 g of steam at 373 K (100°C) contains 2260 J of heat energy more in the form of latent heat of vaporization as compared to water at 373 K(100°). Thus steam produces more severe burns.

Q.9 Naphthalene balls disappear with time without leaving any solid why?
Sol. Naphthalene is volatile solid and has a tendency to sublime, therefore, it changes into vapours completely which disappear into the air and no solid is left.

Q.10 We cna get the smell of perfume sitting several metere away.
Ans. This is because perfumes contain volatile solvent which carries pleasent smelling vapour. They diffuse quite fast and can reach to people sitting several metere away.

EXERCISE – I BOARD PROBLEMS

Q.1 Give reasons for the following observation: The smell of hot sizzling food reaches you several metres away, but to get the smell from cold food you have to go close.

Q.2 Give reasons :
(a) A gas fills completely the vessel in which it is kept.
(b) A gas exerts pressure on the walls of the container.
(c) A wooden table should be called a solid.
(d) We can easily move our hand in air but to do the same through a solid block of wood we need a karate expert.

Q.3 Why does a desert cooler cool better on a hot dry day?

Q.4 Convert the following temperatures to the Celsius scale.

Q.5 What produce more sever burns boiling water or steam?

Q.6 Define matter.

Q.7 What is plasma?

Q.8 What is Bose-Einstein condensate [BEC]?

Q.9 Why do we see water droplets on the outer surface of a glass container of ice cold water?

Q.10 Define specific heat of substance.

Q.11 Define latent heat of a substance.

Q.12 Why gases are compressible but not liquids?

Q.13 Give two factors which determine the rate of diffusion of a liquid in another liquid.

Q.14 Arrange the solids, liquids and gases in order of :
(A) increasing intermolecular space
(b) Increasing intermolecular force

Q.15 Which phenomenon occurs during the following changes :
(a) Formation of clouds
(b) Drying of wet clothes
(c) Was melts in the sun
(d) Size of naphthalene balled decreases

Q.16 Why does a wet khus-khus screen hung at the door keep the room cool?

Q.17 What is mean by evaporation? How is this process different from boiling?

Q.18 Why can you smell the perfume of incense stick

Q.19 Why cannot you smell its perfume at a short distance when incense stick is not lighted ?

Q.20 Why is the smell of the perfume of incense stick filled the whole room in few minutes, when lighted ?

Q.21 A rubber band is a solid, but it can change its shape. Why ?

Q.22 When salt or sugar are poured into different kinds of vessels, why do they take the shape of vessel ?

Q.23 Sponge is a solid, yet we are able to compress it. Why ?

Q.24 Arrange the following substances in the increasing order of forces of attraction between the particles – water, sugar and oxygen.

Q.25 What is the physical state of water at :
(a) 25°C (b) 0°C (c) 100°C

Q.26 Give two reason to justify.
(a) Water at room temperature is a liquid.
(b) An iron almirah is solid at room temperature.

Q.27 State your observation immediately after adding the blue ink drop.

Q.28 State your observation immediately after adding the honey drop.

Q.29 How much time does it take for the colour of ink to spread evenly ?

Q.30 How does the diffusion of honey varies with the diffusion of ink and why ?

Q.31 What happens around each crystal of solid on introducing in water ?

Q.32 What happens as the time passes, and why ?

Q.33 Does the rate of diffusion change with temperature ? If so, why ?

EXERCISE – II OLYMPIAD QUESTIONS

Q.1 When salt is dissolved in water :-
(A) Boiling point increases
(B) Boiling point does not change
(C) Boiling point decreases
(D) None of the above

Q.2 Mixture of butane, ethane and propane is called:-
(A) Coal gas (B) Oil gas
(C) Petroleum gas (D) Producer gas

Q.3 In the kinetic theory of gases, it is assumed that molecular collisions are :-
(A) Inelastic
(B) Short in duration
(C) One-dimensional
(D) Not able to exert mutual forces

Q.4 Triple point of water is :-
(A) 373.16 K (B) 273.16° F
(C) 273.16 K (D) 273.16 F

Q.5 Based on the statements given here choose the correct answer.
(1) Same sugar can be added to a full glass of water without causing overflow.
(2) A liquid is continuous even-though space is present between the molecules.
(A) (1) and (2) are true and (2) explains (1)
(B) (1) and (2) are true but (2) does not explain (1)
(C) Only (1) is true
(D) Only (2) is true

Q.6 Vanderwaal's forces are also known as :-
(A) Intermolecular forces
(B) Intramolecular forces
(C) Atomic forces
(D) Molecular forces

Q.7 Based on the statements given here choose the correct answer.
(1) If we increase the temperature of a gas inside a container, its pressure also increases.
(2) Upon heating, the rate of collisions of the gas molecules increase and increases the impact of force onthe walls of the container.
(A) (1) and (2) are true and (2) explains (1)
(B) (1) and (2) are true but (2) does not explain(1)
(C) Only (1) is true
(D) Only (2) is true

Q.8 Match the following and choose the correct answer :-
(i) Solid
(a) Super energetic particles
(ii) Liquid
(b) No shape nor fixed volume at a given pressure
(iii) Gas
(c) Has definite shape
(iv) Plasma
(d) Define shape with less molecular forces than that in solids
(A) (i) – a, (ii) – b, (iii) – c, (iv) – d
(B) (i) – c, (ii) – d, (iii) – b, (iv) – a
(C) (i) – c, (ii) – d, (iii) – a, (iv) – b
(D) (i) – a, (ii) – d, (iii) – b, (iv) – c

Q.9 The process for the change of a solid directly into its vapour is called –
(A) Evaporation (B) Ebullition
(C) Condensation (D) Sublimation

Q.10 When water particles condenses on air on dust, it forms :-
(A) mist (B) fog
(C) frost (D) Vapour

Q.11 Which is more effective in cooling ?
(A) Water at 0°C (B) Water at 100°C
(C) Ice at 0°C (D) All of these

Q.12 The temperature at which Celsius and Fahrenheit scales show the same reading is:-
(A) 40° K (B) 100° F
(C) – 40° C (D) – 100°C

Q.13 Latent heat of fusion for ice is :-
(A) 80 gm cal^{-1} (B) 80 cal / gm
(C) 19 J cal^{-1} (D) None of these

Q.14 Based on the statements given here choose the correct answer.

(1) In polar regions aquatic life is safe in water under frozen ice.

(2) Water has a high latent heat of fusion and the upper portion of ice does not allow the heat of the waterto escape to the surroundings.

(A) (1) and (2) are true and (2) explains (1)

(B) (1) and (2) are true but (2) does not explain (1)

(C) Only (1) is true

(D) Only (2) is true

Q.15 Based on the statements given here choose the correct answer.

(1) Boiling point of a liquid increases with increase in temperature.

(2) The volume of liquids increases on boiling and the vaporisation curve shows the variation of the boilingpoint of a liquid with pressure and expands the equilibrium state between liquid and vapour phase.

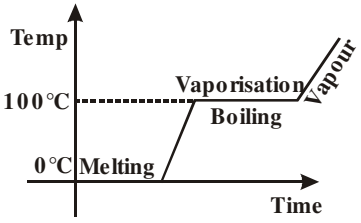
(A) (1) and (2) are true and (2) explains (1)

(B) (1) and (2) are true but (2) does not explain(1)

(C) Only (1) is true

(D) Only (2) is true

Q.16 In an experiment of conversion of ice into water and water into vapour, observations were recorded and a graph plotted for temperature against time as shown below. From the graph it can be concluded that :-



(A) Ice takes time to heat up to 0°C

(B) During melting and boiling temperature does not rise

(C) Process of boiling takes longer time than the process of melting

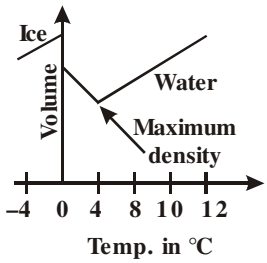
(D) All the above

Q.17 The SI unit of temperature is :-

(A) °C (B) °F

(C) K (D) All of the above

Q.18 Study the graph given below and select the correct statement :-



(A) When water is cooled to 4°C it contracts

(B) At 0°C water freezes

(C) The volume of ice is more than that of water

(D) All of these

Q.19 The solid state of CO_2 is called :-

(A) Tear gas (B) Cooking gas

(C) Dry ice (D) Laughing gas

Q.20 Corresponding temperature in the Kelvin scale for 104°C F is :-

(A) 313 K (B) 203

(C) 308 K (D) 377 K

Q.21 When the vapour pressure of a liquid is equal to its atmospheric pressure, then it :-

(A) Freezes

(B) Evaporates

(C) Boils

(D) Does not undergo any change

Q.22 When ice is converted into water :-

(A) Heat is absorbed

(B) Heat is released

(C) Temperature increases

(D) Temperature decreases

Q.23 Which of the following has the strongest interparticle force at the room temperature?

(A) Nitrogen (B) Mercury

(C) Iron (D) Chalk

Q.24 What is volume of gases?

(A) Definite

(B) Almost Nil

(C) Large

(D) Take the volume of container

Q.25 The change of state from solid to liquid known as –

(A) Fusion (B) Boiling

(C) Melting (D) None of these

Q.26 Dry ice is –

(A) Water in solid state

(B) Water in gaseous state

(C) CO_2 in liquid state

(D) CO_2 in solid state

Q.27 The boiling point of water on kelvin scale is–

(A) 573 K (B) 273 K

(C) 373 K (D) 100 K

Q.28 The process of change of a liquid into vapour at any temperature is called –

(A) Diffusion (B) Evaporation

(C) Cooling (D) Heating

Q.29 Which factor affecting Evaporation –

(A) Temperature (B) Surface area

(C) Both (A) & (B) (D) None of these

Q.30 On increasing the temperature of the liquid the rate of evaporation is –

(A) Increase (B) Decreases

(C) No change (D) None of these

Q.31 Fluids are –

(A) Liquids and gases

(B) Solids and gases

(C) Liquids and solids

(D) Only solids

Q.32 Which substance undergo sublimation process–

(A) Naphthalene (B) CO_2

(C) Ice (D) N_2

Q.33 Condensation process is –

(A) Change of state from gas to liquid

(B) Change of state from liquid to gas

(C) Change of state from gas to solid

(D) Change of state from solid to liquid

Q.34 The temperature at which liquid starts boiling at atmospheric pressure known as –

(A) Melting point (B) Boiling point

(C) Latent heat (D) Condensation

Q.35 The melting point of ice is –

(A) 0°C (B) 4°C

(C) 5°C (D) None of these

Q.36 The physical state of matter which can be easily compressed –

(A) Liquid (B) Gas

(C) Solid (D) None of these

Q.37 Name the process by which a drop of ink spreads in a beaker of water –

(A) Diffusion (B) Vaporization

(C) Condensation (D) Sublimation

Q.38 The temperature at which a solid changes into liquid at atmospheric pressure is called –

(A) Melting point (B) Boiling point

(C) Diffusion (D) Evaporation

Q.39 Convert the temperature of 373°C to the kelvin scale ?

(A) 646 K (B) 546 K

(C) 300 K (D) 500 K

Q.40 Convert the temperature of 270 K to the celsius scale –

(A) – 3°C (B) – 4°C

(C) 2°C (D) 5°C

Q.41 Plasma is the..... state of matter –

(A) First (B) Second

(C) Third (D) Fourth

Answers

1.	C	**2.**	C	**3.**	B	**4.**	C
5.	A	**6.**	A	**7.**	A	**8.**	B
9.	D	**10.**	A	**11.**	C	**12.**	C
13.	B	**14.**	A	**15.**	A	**16.**	D
17.	C	**18.**	D	**19.**	C	**20.**	A
21.	C	**22.**	A	**23.**	C	**24.**	D
25.	C	**26.**	D	**27.**	C	**28.**	B
29.	C	**30.**	A	**31.**	A	**32.**	A
33.	A	**34.**	B	**35.**	A	**36.**	B
37.	A	**38.**	A	**39.**	A	**40.**	A
41.	D						

NCERT BASED QUESTIONS

EXERCISE-III

SECTION-A

- **Fill in the blanks**

1. The best evidence that the particles of matter are constantly moving comes from the studies of _____ and _____.
2. When ice melts there is a _____ in volume.
3. The stars and sun glow because of the presence of _____in them.
4. Anything that occupies space and has mass is called_____
5. The intermixing of particles of two substances on their own is called _____
6. Solid, liquid and gas are called the _____ of matter.
7. The mass per unit volume of a substance is called _____
8. The smell of perfume gradually spreads across a room due to _____
9. Increase in pressure _____the boiling point of water.
10. When steam condense to form water, heat is _____.

SECTION-B

- **Multiple choice question with one correct answers**

1. According to ancient philosphers matter consists of
   (A) three constituents (B) four constituents (C) five constituents (D) six constituents
2. Which of the following is not matter?
   (A) air (B) feeling of cold (C) dust (D) humidity
3. Which of the following statements is not correct?
   (A) Matter is continuous in nature
   (B) Interparticle spaces are maximum in the gaseous state of a substance
   (C) Particles which constitute the matter follow a zig-zag path
   (D) Solid state is the most compact state of a substance
4. The mass per unit volume of a substance is called :
   (A) density (B) valency (C) solubility (D) none of above
5. A gas can be best liquefied
   (A) by increasing the temperature
   (B) by lowering the pressure
   (C) by increasing the pressure and reducing the temperature
   (D) none of these is correct
6. Evaporation of a material takes place :
   (A) above its boiling point (B) below its boiling point
   (C) at its melting point only (D) below its melting point
7. Which of the following exists as gas?
   (A) Petrol (B) Helium (C) Sodium (D) Iodine
8. 10°C temperature is equal to
   (A) 163 K (B) 10 K (C) 183 K (D) 283 K
9. Which of the following will respond to sublimation?
   (A) Common salt (B) Sugar (C) Camphor (D) Potassium nitrate
10. Which of the following statements do not go with the liquid state?
    (A) Particles are loosly packed in the liquid state

(B) Fluidity is the maximum in the liquid state

(C) Liquids cannot be compressed

(D) Liquids take up the shape of any container in which they are placed

SECTION-C

- **Match the following (one to one)**

Column-I and **column-II** contains **four** entries each. Entries of column-I are to be matched with some entries of column-II. Only One entries of column-I may have the matching with the same entries of column-II and one entry of column-II Only one matching with entries of column-I

1.

Column I	**Column II**
(A) Spread sweet odour into the atmosphere	(P) Sublimation
(B) Change of liquid state to gaseous state	(Q) Diffusion
(C) Change of solid state directly to gaseous state	(R) Condensation
(D) The gas changing to a liquid	(S) Vaporization

EXERCISE-IV

SECTION-A

- **Multiple choice question with one correct answers**

1. The physical state of water at 100°C is
   (A) Solid (B) Liquid (C) Gas (D) None of these
2. The state of matter that can be easily compressed is
   (A) Solid (B) Liquid
   (C) Gas (D) Super cooled solid
3. A substance which has a definite volume but no definite shape is
   (A) Solid (B) Liquid (C) Gas (D) None of these
4. Evaporation of a liquid occurs at
   (A) Boiling point (B) Fixed temperature lower than the boiling point
   (C) All temperatures (D) None of these
5. The change from vapour to liquid is called
   (A) Condensation (B) Fusion (C) Sublimation (D) None of these
6. The melting point of ice is
   (A) 273.16 K (B) 373.16 K (C) 283.16 K (D) 263.16 K
7. The change from solid to gas directly is called
   (A) Vaporization (B) Sublimation (C) Condensation (D) None of these
8. Diffusion is a property of matter, based on
   (A) Motion of its particles (B) Size of its particles (C) Pressure (D) Temperature
9. The SI unit of temperature is
   (A) Celsius (B) Kelvin (C) Farenhiet (D) None of these
10. The process of changing liquid into solid is called
    (A) Evaporation (B) Freezing (C) Condensation (D) Sublimation
11. The state of which 99% matter of the universe is
    (A) Plasma (B) Solid (C) Gaseous (D) Liquid
12. The tendency of non-reacting gases to mix with each other is called as
    (A) Chemical reaction (B) Diffusion (C) Effusion (D) Explosion

SECTION-B

- **Multiple choice question with one or more than one correct answers**

1. Which of the following are states of matter?
   (A) Solid (B) Liquid (C) Gas (D) Plasma

2. Physical state of matter can be changed by
   (A) change of pressure (B) change of volume
   (C) change of temperature (D) change of composition.
3. Solids have/can
   (A) Fixed shape (B) Fixed volume (C) Flow easily (D) Low densities
4. The particles of matter are
   (A) Very, very small (B) Constanty moving
   (C) Repelled by each other (D) Tightly packed
5. In which of the following states, water can exist
   (A) Solid (B) Liquid (C) Gas (D) Plasma
6. Which of the following will undergo sublimation?
   (A) Ammonium chloride (B) Sodium chloride (C) Iodine (D) Methanol
7. Evaporation of a liquid mainly depends upon
   (A) Temperature (B) Pressure (C) Surface area (D) Wind speed
8. Which of the following factors are responsible for change in state of solid carbon dioxide when kept exposed to air?
   (A) Increase in pressure (B) Decrease in pressure
   (C) Decrease in temperature (D) Increase in temperature
9. The best evidence that the particles of matter are constantly moving comes from the studies of :
   (A) Diffusion (B) Fusion (C) Brownion motion (D) Tyndall effect
10. Which state of matter does not consists of superenergetic and super excited particles in the form of ionised gases ?
    (A) Super cooled (B) Solid (C) Liquid (D) Plasma
11. The factors which effects the diffusion are:-
    (A) Density (B) Temperature (C) Physical state (D) None of these
12. A soild sphere is immersed in a fluid.The magnitude of buoyant force experienced by the sphere depends on the
    (A) Density of the fluid (B) Density of the solid
    (C) Volume of the fluid (D) Volume of the solid immersed in the fluid
13. Which of the following is/are characteristics of liquids ?
    (A) Fixed volume (B) Definite shape
    (C) Flow easily (D) Moderate compressibility

SECTION-C

- **Comprehension**

We use celsius scale of temperature for measuring temperature in our everyday life. But the S.I. Unit of measuring temperature is Kelvin which is denoted by symbol K. The melting point of ice on kelvin scale is 273 K and the boiling point of water on kelvin scale is 373 K.

Temperature on kelvin scale = Temperature on celsius scale +273

Now answer the following questions

1. The kelvin temperature is 270 K. What is the corresponding celsius scale temperature?
   (A) 373°C (B) 543°C (C) –3°C (D) –1°C
2. Convert the temperature of 573 K to the celsius scale
   (A) 300°C (B) 400°C (C) 500°C (D) 600°C
3. Convert the temperature of 373°C into the kelvin scale
   (A) 546 K (B) 646 K (C) 351 K (D) None
4. The kelvin scale temperature is 0 K. What is the corresponding celsius scale temperature?
   (A) –273°C (B) 273°C (C) 373°C (D) None of these

SECTION-D

- **Match the following (one to many)**

Column-I and **column-II** contains **four** entries each. Entries of column-I are to be matched with some entries of column-II. One or more than one entries of column-I may have the matching with the same entries of column-II and one entry of column-II may have one or more than one matching with entries of column-I

1.

Column I	**Column II**
(A) Solid	(P) Have a fixed volume
(B) Liquid	(Q) Mixture of free electrons and ions
(C) Gas	(R) Do not have fixed shape
(D) Plasma	(S) Flow easily

******

Answers

Exercise-III

Section-A

1. Diffusion and Brownian motion.
2. Decrease
3. Plasma
4. Matter
5. Diffusion
6. Three states
7. Density
8. Diffusion
9. Increase
10. Evolved

Section-B

1.	(C)	2.	(B)	3.	(A)	4.	(A)	5.	(C)
6.	(B)	7.	(B)	8.	(D)	9.	(C)	10.	(B)

Section-C

1. (A)-(Q), (B)-(S), (C)-(P), (D)-(R)

Exercise-IV

Section-A

1.	(C)	2.	(C)	3.	(B)	4.	(C)	5.	(A)
6.	(A)	7.	(B)	8.	(A)	9.	(B)	10.	(B)
11.	(A)	12.	(B)						

Section-B

1.	(A,B,C,D)	2.	(A,C)	3.	(A,B)	4.	(A,B)	5.	(A,B,C)
6.	(A,C)	7.	(A,C,D)	8.	(B,D)	9.	(AC)	10.	(A,B,C)
11.	(A,B,C)	12.	(A,D)	13.	(A,C,D)				

Section-C

1.	(C)	2.	(A)	3.	(B)	4.	(A)

Section-D

1. (A)-(P), (B)-(P,R,S), (C)-(R,S), (D)-(Q)

EXERCISE – V NTSE / ISO / IJO QUESTIONS

1. When salt is dissolved in water :-

(A) Boiling point increases (B) Boiling point does not change

(C) Boiling point decreases (D) None of the above

2. Mixture of butane, ethane and propane is called :-

(A) Coal gas (B) Oil gas (C) Petroleum gas (D) Producer gas

3. In the kinetic theory of gases, it is assumed that molecular collisions are :-

(A) Inelastic (B) Short in duration

(C) One-dimensional (D) Not able to exert mutual forces

4. Triple point of water is :-

(A) 373.16 K (B) 273.16° F (C) 273.16 K (D) 273.16 F

5. Based on the statements given here choose the correct answer.

(1) Same sugar can be added to a full glass of water without causing overflow.

(2) A liquid is contianuous even-though space is present between the molecules.

(A) (1) and (2) are true and (2) explains (1)

(B) (1) and (2) are true but (2) does not explain (1)

(C) Only (1) is true (D) Only (2) is true

6. Vanderwaal's forces are also known as :-

(A) Intermolecular forces (B) Intramolecular forces

(C) Atomic forces (D) Molecular forces

7. Based on the statements given here choose the correct answer.

(1) If we increase the temperature of a gas inside a container, its pressure also increases.

(2) Upon heating, the rate of collisions of the gas molecules increase and increases the impact of force on the walls of the container.

(A) (1) and (2) are true and (2) explains (1)

(B) (1) and (2) are true but (2) does not explain (1)

(C) Only (1) is true (D) Only (2) is true

8. Match the following and choose the correct answer :-

(i) Solid	(a) Super energetic particles
(ii) Liquid	(b) No shape nor fixed volume at a given pressure
(iii) Gas	(c) Has definite shape
(iv) Plasma	(d) Define shape with less molecular forces than that in solids

(A) (i) – a, (ii) – b, (iii) – c, (iv) – d (B) (i) – c, (ii) – d, (iii) – b, (iv) – a

(C) (i) – c, (ii) – d, (iii) – a, (iv) – b (D) (i) – a, (ii) – d, (iii) – b, (iv) – c

9. Match the following and choose the correct answer.

(i) Evaporation	(a) Liquid to gas at a fixed temperature
(ii) Vaporisation	(b) Solid to gas
(iii) Sublimation	(c) Gas to solid
(iv) Hoar frost	(d) Liquid into gas at any temperature

(A) (i) – a, (ii) – b, (iii) – c, (iv) – d (B) (i) – c, (ii) – d, (iii) – b, (iv) – a

(C) (i) – c, (ii) – d, (iii) – a, (iv) – b (D) (i) – a, (ii) – d, (iii) – b, (iv) – c

10. When water particles condenses on air on dust, it forms :-

(A) mist (B) fog (C) frost (D) Vapour

11. Which is more effective in cooling ?

(A) Water at 0°C (B) Water at 100°C (C) Ice at 0°C (D) All of these

12. The temperature at which Celsius and Fahrenheit scales show the same reading is :-

(A) 40° K (B) 100° F (C) – 40° C (D) – 100°C

13. Latent heat of fusion for ice is :-

(A) 80 gm cal^{-1} (B) 80 cal / gm (C) 19 J cal^{-1} (D) None of these

14. Based on the statements given here choose the correct answer.

(1) In polar regions aquatic life is safe in water under frozen ice.

(2) Water has a high latent heat of fusion and the upper portion of ice does not allow the heat of the water to escape to the surroundings.

(A) (1) and (2) are true and (2) explains (1)

(B) (1) and (2) are true but (2) does not explain (1)

(C) Only (1) is true

(D) Only (2) is true

15. Based on the statements given here choose the correct answer.

(1) Boiling point of a liquid increases with increase in temperature.

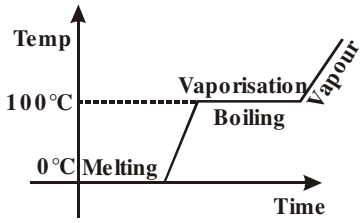
(2) The volume of liquids increases on boiling and the vaporisation curve shows the variation of the boiling point of a liquid with pressure and expands the equilibrium state between liquid and vapour phase.

(A) (1) and (2) are true and (2) explains (1)

(B) (1) and (2) are true but (2) does not explain (1)

(C) Only (1) is true (D) Only (2) is true

16. In an experiment of conversion of ice into water and water into vapour, observations were recorded and a graph plotted for temperature against time as shown below. From the graph it can be concluded that :-



(A) Ice takes time to heat up to 0°C

(B) During melting and boiling temperature does not rise

(C) Process of boiling takes longer time than the process of melting

(D) All the above

17. The SI unit of temperature is :-

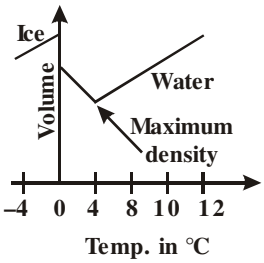
(A) °C

(B) °F

(C) K

(D) All of the above

18. Study the graph given below and select the correct statement :-



(A) When water is cooled to 4°C it contracts

(B) At 0°C water freezes

(C) The volume of ice is more than that of water

(D) All of these

19. The solid state of CO_2 is called :-

(A) Tear gas (B) Cooking gas (C) Dry ice (D) Laughing gas

20. Corresponding temperature in the Kelvin scale for 104°C F is :-

(A) 313 K (B) 203 (C) 308 K (D) 377 K

21. When the vapour pressure of a liquid is equal to its atmospheric pressure, then it :-

(A) Freezes (B) Evaporates

(C) Boils (D) Does not undergo any change

22. When ice is converted into water :-

(A) Heat is absorbed (B) Heat is released

(C) Temperature increases (D) Temperature decreases

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13
Ans.	C	C	B	C	A	A	A	B	A	A	C	C	B
Que.	14	15	16	17	18	19	20	21	22				
Ans.	A	A	D	C	D	C	A	C	A				

IS MATTER AROUND US PURE

1. Any substance which possesses definite mass, occupies definite volume and offers resistance to external force is called matter.

2. An elementary substance contains only one kind of atoms.

3. A chemical substance which can be split into or built up from two or more dissimilar substances is called a compound.

4. All elements and compounds are homogeneous.

5. If the components mix up thoroughly in all proportions then it is called a homogeneous mixture.

6. If the components do not mix up thoroughly and can be demarcated by boundaries, then it is called a heterogeneous mixture.

DIFFERENCES BETWEEN COMPOUNDS AND MIXTURES

7. Compound formation is a chemical change.

Formation of a mixture is a physical change.

8. Compounds are formed by the combination of two or more elements which combine in a fixed ratio by weight.

In the formation of a mixture, no fixed ratio is maintained.

9. The constituent elements lose their individual properties.

The components retain their individual properties.

10. All compounds are homogeneous.

Mixtures may be homogeneous or heterogeneous.

11. Compounds have definite values for density, melting point and boiling point.

Mixtures do not have definite values for density, melting point and boiling point.

12. The proportion of the constituent elements is same.

The proportion of the components can be varied.

13. Compound formation is accompanied by heat energy changes.

Heat energy changes rarely occur in the preparation of mixtures.

14. The constituents are not easily separable.

The components are easily separable.

15. Compounds have definite molecular weights.

Mixtures do not have molecular weights.

All the matter around us is not pure. The matter around us is of two types : pure substances and mixtures.

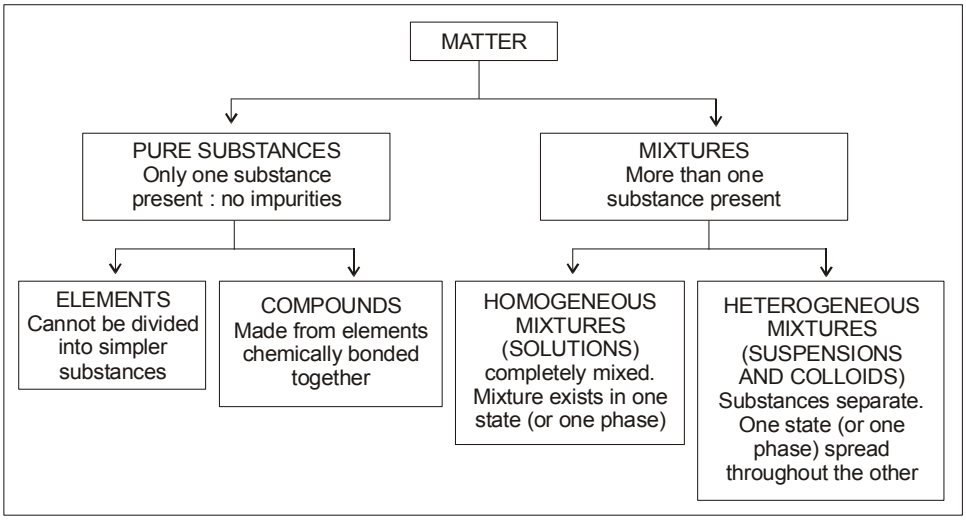
- **Pure Substances**

A pure substance is one which is made up of only one kind of particles. All the element and compounds are pure substances because they contain only one kind of particles like hydrogen, oxygen, chlorine, iodine, carbon, iron, copper, silver, gold are pure substances. A pure substance cannot be separated into other kinds of matter by any physical process.

- **Impure Substances : Mixtures**

A mixture is one which contains two or more different kinds of particles (atoms or molecules). All the mixtures are impure substances because they contain more than one kind of particles. Examples of the mixtures are : Salt solution, sugar solution, milk, sea-water.

All the matter can be divided into three general classes : elements, compounds and mixtures.


MATTER
PURE SUBSTANCES
Only one substance present : no impurities
MIXTURES
More than one substance present
ELEMENTS
Cannot be divided into simpler substances
COMPOUNDS
Made from elements chemically bonded together
HOMOGENEOUS MIXTURES (SOLUTIONS)
completely mixed. Mixture exists in one state (or one phase)
HETEROGENEOUS MIXTURES (SUSPENSIONS AND COLLOIDS)
Substances separate. One state (or one phase) spread throughout the other

ON YOUR TIPS

Element & compounds are pure substances. Mixtures are not pure substances in terms of science.

ELEMENTS

An element is a substance which cannot be split up into two or more simpler substances by the usual chemical methods of applying heat, light or electric energy.

An element cannot be split up into two (or more) simpler substances because it is made of only one kind of atoms.

For example, copper metal is made of only one kind of atoms called 'copper atoms'. Every substance in this world is made up of one or more of these elements.

Elements can be solids, liquids or gases. For example, sodium and carbon elements are solids, mercury and bromine elements are liquids, whereas hydrogen and oxygen elements are gases.

Hydrogen is an element because it cannot be split up into two or more simpler substances by the usual methods of carrying out chemical reactions by applying heat, light or electricity.

Element	Symbol
Aluminium	Al
Arsenic	As
Barium	Ba
Bromine	Br
Cadmium	Cd
Calcium	Ca
Chlorine	Cl
Chromium	Cr
Cobalt	Co
Fluorine	F
Hydrogen	H
Iodine	I
Magnesium	Mg
Manganese	Mn
Nitrogen	N
Oxygen	O
Phosphorus	P
Sulphur	S
Uranium	U
Zinc	Zn

- **Metals Non-Metals and metalloids**

All the elements can be divided into three groups :

1. Metals, 2. Non-metals, and 3. Metalloids

◈ METALS

A metal is an element that is melleable and ductile, and conducts electricity. Examples of metals are : Iron, Copper, Aluminium, Zinc, Silver, Gold.

All the metals are solids except one metal mercury, which is a liquid.

- **Properties of Metals**

1. **Metals are Melleable.** This means that metals can be beaten into thin sheets with a hammer (without breaking). For example, silver metal can be hammered into thin silver foils because of its high malleability.
2. **Metals are ductile.** This means that metals can be drawn (or stretched) into thin wires. All the metals are not equally ductile. Some are more ductile than the other. For example, just 100 milligrams of a highly ductile metal like silver can be drawn into a thin wire about 200 metres long.
3. **Metals are good conductors of heat and electricity.** This means that metals allow heat and electricity to pass through them easily. Silver metal is the best conductor of heat. It has the highest thermal conductivity. Silver metal is the best conductor of heat. The cooking utensils and water boilers, etc., are usually made of copper or aluminiummetals because they are very good conductors of heat. Silver metal is the best conductor of electricity. The electric wires are made of copper and aluminium metals because they are very good conductors of electricity.
4. **Metals are Iustrous (or shiny), and can be polished.** The property of a metal of having a shining surface is called metallic lustre (chamak). The shiny appearance of metals makes them useful in making jewellery and decoration pieces For example, gold and silver are used for making jewellery because they are bright and shiny. The shiny surface of metals makes them good reflectors of light. Silver metal is an excellent reflector of light.
5. **Metals are generally hard** Most of the metals are hard. But all the metals are not equally hard. The hardness varies from metal to metal they can not cut with a knife. (except sodium and potassium which are soft metals) (except sodium and potassium which are soft metals).
6. **Metals are usually strong.** This means that metals can hold large weights without breaking. They have high tensile strength. For example, iron metal (in the form of steel) having a high tensile strength. Due to this iron metal is used in the construction.
7. **Metals are solids at the room temperature** (except mercury which is a liquid metal). All the metals like iron, copper, aluminium, silver and gold, etc., are solids at the room temperature. Only one metal, mercury, is in liquid state at the room temperature.
8. **Metals generally have high melting points and boiling points.** This means that most of the metals melt and vaporise at high temperatures. Some exceptions, Sodium and potassium metals have low melting points.
9. **Metals have high densities.** This means that metals are heavy substances. For example, the density of iron metal is 7.8 g/cm^3 which is quite high. Some exceptions. Sodium and potassium metals have low densities.
10. **Metals are sonorous.** This means that metals make a ringing sound when we strike them. For example, Plate type musical instruments like cymbals (manjira), and wires (or strings) for stringed musical instruments such as violin, guitar, sitar and tanpoora, etc

◈ NON-METALS

A non-metal is an element that is neither malleable nor ductile, and does not conduct electricity. Examples of non-metals are : Carbon, Sulphur. Oxygen, Nitrogen, Fluorine, Chlorine. All the non-metals are solids or gases, except bromine which is a liquid non-metal at room temperature.

- **Properties of Non-Metals**

1. **Non-metals are not malleable.** Non-metals are brittle. For example, sulphur and phosphorus are solid non-metals which are not malleable, they cannot be beaten into thin sheets with a hammer.
2. **Non-metals are not ductile.** For example, sulphur and phosphorus are non-metals and they are not ductile.
3. **Non-metals are bad conductors of heat and electricity.** For example, sulphur and phosphorus are non-metals which do not conduct heat or electricity. Some exceptions. Diamond is a non-metal which is a good conductor of heat. Graphite is a non-metal which is a good conductor of electricity.
4. **Non-metals are not Iustrous.** They are dull in appearance. An exception. Iodine is a non-metal having Iustrous appearance.
5. **Non-metals are generally soft** (except diamond which is extremely hard non-metal).
6. **Non-metals are not strong.** They have low tensile strength. For example graphite is a non-metal which is not strong. It has a low tensile strength.
7. **Non-metals may be solid, liquid or gases at the room temperature.**
8. **Non-metals have comparatively low melting points and boiling points** (except graphite which is a non-metal having a very high melting point 3700ºC).
9. **Non-metals have low densities.** For example, sulphur is a solid non-metal having a low density of 2g/cm^3. One non-metal iodine has, however, high density.
10. **Non-metals are not sonorous.**

◈ METALLOIDS

The elements which show some properties of metals and some other properties of non-metals are called metalloids.

The important examples of metalloids are : Boron (B), Silicon (Si), and Germanium (Ge).

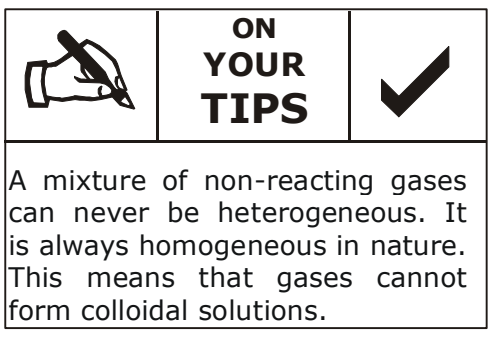
MIXTURES

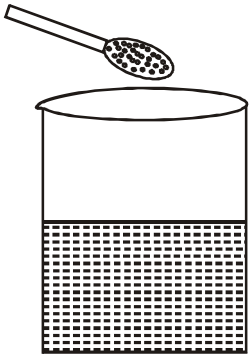
A mixture is a substance which consists of two or more elements or compounds not chemically combined together. All the solutions are mixtures. Some of the examples of mixtures are : Air, Gunpowder, Milk, Sea-water, Ink.

- **Types of Mixtures**

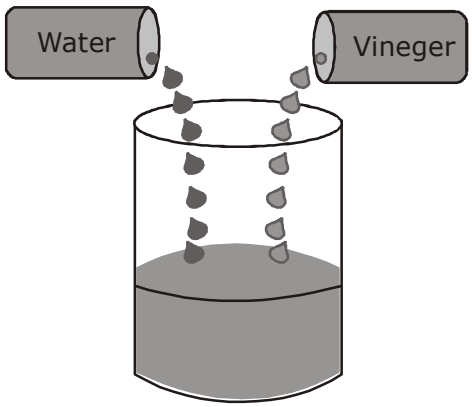
1. Homogeneous mixtures, and
2. Heterogeneous mixtures

1. **Homogeneous mixtures:** Those mixtures in which the substances are completely mixed together and are indistinguishable from one another, are called homogeneous mixtures. All the homogeneous mixtures are called solutions. Examples of homogeneous mixtures: Sugar solution, Salt solution, Sea-water, Alcohol and water mixture, Petrol and oil mixture.


ON
YOUR
TIPS
A mixture of non-reacting gases can never be heterogeneous. It is always homogeneous in nature. This means that gases cannot form colloidal solutions.



Salt in water is a homogeneous mixture



A solution of vinegar in water is a homogeneous mixture.

2. **Heterogeneous mixtures:** Those mixtures in which the substances remain separate and one substance is spread throughout the other substance as small particles, droplets or bubbles, are called heterogeneous mixtures. The suspensions of solids in liquids are also heterogeneous mixtures. A mixture containing two (or more) immiscible liquids is also a heterogeneous mixtures. All the suspensions and colloids are heterogeneous mixtures. Examples of heterogeneous mixtures are : Sugar and sand mixture, Salt and sand mixture, Milk, Soap solution, Blood. Most of the mixtures are heterogeneous, only solutions and alloys are homogeneous mixtures.

COMPOUNDS

A compound is a substance made up of two or more elements chemically combined in a fixed proporton by mass. For example, water (H_2O) is a compound made up of two elements, hydrogen and oxygen, chemically combined in a fixed proportion of 1:8 by mass.

Some more examples of compounds are : Ammonia (NH_3), Carbon dioxide (CO_2), Ice (H_2O), Steam (H_2O). Compounds can be further divided into three classes : acids, bases and salts, on the basis of their properties.

Differences between mixture and coumpounds

Mixture	Compound
1 A mixture can be separated into its constituents by the physical processes (Like filtration, evaporation etc.) sublimation, distillation, solvents, magnet, etc.)	1 A compound cannot be separated into its constituents by physical processes (It can only be separated into its constituents by chemical processes).
2 A mixture shows the properties of its constituents.	2 The properties of a compound are entirely different from those of its constituents.
3 Energy (in the form of heat, light, etc.) is usually neither given out nor absorbed in the preparation of a mixture	3 Energy (in the form of heat, light, etc.) is usually given out or absorbed during the preparation of a compound.
4 The composition of a mixture is variable, the constituents can be present in any proportion by mass. A mixture does not have definite formula	4 The composition compound of a compound is fixed, the constituents are present in fixed proportion by mass.
5 A mixture does not have a fixed melting point, boiling point.	5 A compound has a fixed melting point, boiling point.

SOLUTIONS, SUSPENSIONS AND COLLOIDS

The 'substance which is dissolved' in a liquid to make a solution is called 'solute', and the liquid' in which solute is dissolved is known as 'solvent'. For example, salt solution is made by dissolving salt in water, so in salt solution, 'salt' is the 'solute' and 'water' is the 'solvent'.

◈ SOLUTION

A solution is a homogeneous mixture of two (or more substances). Some common examples of solutions are : Salt solution, Sugar solution, Vinegar, Metal alloys and Air.

Salt solution and sugar solution are also known as true solutions because in these solutions the particles of salt and sugar are mixed so well with water that we cannot distinguish one from the other. Only soluble substances form true solutions.

ON YOUR TIPS

A solution in which water acts as the solvent is called an aqueous solution while the one in which any other liquid acts as the solvent is called a non-aqueous solution.

A sugar solution does not scatter a beam of light passing through it and render its path visible. (Because the sugar particles present in it are so small that they cannot reflect light rays falling on them).

Tincture of iodine is generally available by the name of Lugol.

Alloy is a homogeneous mixture of metal with metal or metal with non-metal.

- **Properties of a Solution**

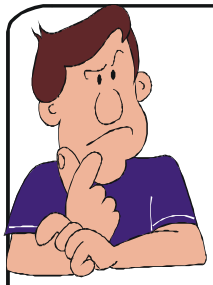
1. A solution is a homogeneous mixture.
2. The size of solute particles in a solution is extremely small. It is less than 1 nm in diameter (1 nanometre = 10^{-9} metre).
3. The particles of a solution cannot be seen even with a microscope.
4. The particles of a solution pass through the filter paper.
5. The solutions are very stable.
6. A true solution does not scatter light (This is because its particles are very, very small).

- **Types of Solutions**

The various types of solutions are :

1. **Solution of Solid in a Solid.** Metal alloys are the solutions of solids in solids. For example, brass is a solution of zinc in copper.
2. **Solution of Solid in a Liquid.** Sugar solution and salt solution are the solution of solids in liquids.
3. **Solution of Liquid in a Liquid.** Vinegar is a solution of acetic acid (ethanoic acid) in water.
4. **Solution of Gas in a Liquid.** Soda-water is a solution of carbon dioxide gas in water.
5. **Solution of Gas in a Gas.** Air is a solution of gases like oxygen, argon, carbon dioxide and water vapour, etc.

DO YOU Know



Saturated solution :–

A solution which at a given temperature dissolves as much solute as it is capable of dissolving, is said to be a saturated solution.

Ex. At 30°C, 55 g of common salt dissolves in 100g of water. However, if more of common salt is added to the above solution, it just does not dissolve. In such a situation, the solution of common salt containing 55 gm of salt in 100 gm of water, is a saturated solution at 30°C.

- If a saturated solution at some particular temperature is heated, the solution becomes unsaturated, because of the increase in solubility.
- If a saturated solution at some higher temperature is cooled, it remains saturated. The excess solute comes out of the solution and deposits it self in the form of crystals.

Unsaturated solution :–

When the amount of solute contained in a solution is less than the saturation level, the solution is said to be an unsaturated solution.

Ex. At 30°C, if 45 g of common salt is dissolved in 100 g of water, such solution so formed is capable of dissolving more of the common salt, then such a solution is called unsaturated solution.

Super saturated solution :–

A solution which contains more of the solute than required to make a saturated solution, is called a super saturated solution.

◈ SUSPENSIONS

Those substances which are insoluble in water form suspensions. A suspension is a heterogeneous mixture in which the small particles of a solid are spread throughout a liquid without dissolving in it. Examples of suspensions are : Chalk-water mixture, Muddy water, Milk of magnesia, Sand particles.

- **To Study the Properties of a Suspension**

If a beam of light is passed through a chalk and water suspension, it scatters the beam of light and renders its path visible inside it.

- **Properties of a Suspension**

1. A suspension is a heterogeneous mixture.
2. The size of solute particles in a suspension is quite large. It is larger than 100 nm in diameter.
3. The particles of suspension can be seen easily.
4. The particles of a suspension do not pass through a filter paper.
5. The suspensions are unstable.
6. A suspension scatters a beam of light passing through it (because its particles are quite large).

◈ COLLOIDS

A colloid is a kind of solution in which the size of solute particles is intermediate between those in true solutions and those in suspensions. Some of the examples of colloids (or colloidal solutions) are : Soap solution, Starch solution, Milk, Ink, Blood, Jelly and Solutions of synthetic detergents.

- **To Study the Properties of a Colloid**

It we shake some soap power with water in a beaker, we get a colloidal soap solution which is not perfectly transparent. If the soap solution is kept for some time, the soap particles do not settle down. If we filter the soap solution, the whole solution passes through the filter paper and no residue is left behind. All these observations indicate that soap and water mixture is a true solution. The scattering of light by a soap solution and the examination of soap solution under a high power microscope,

however, show that soap solution is not a true solution.

In a true solution (like sugar solution), the solute particles are so small that they cannot scatter (or reflect) light rays falling on them.

Ice cream is also a colloids

In a colloidal solution (or colloid), the particles are big enough to scatter light. The scattering of light by colloidal particles is known as **Tyndall effect.**

- **Properties of Colloids**

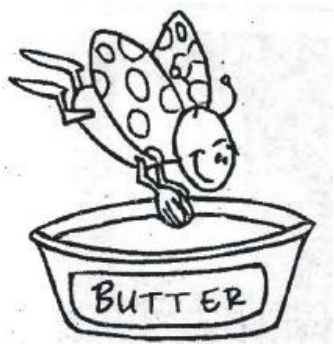
1. A colloid (or colloidal solution) appears to be homogeneous but actually it is heterogeneous.
2. The size of particles in a colloid is bigger than those in a true solution but smaller than those in a suspension. It is between 1 nm and 100 nm in diameter.
3. The particles of most of the colloids cannot be seen even with a microscope.
4. The particles of a colloid can pass through a filter paper. So, a colloid cannot be separated by filtration.
5. The colloids are quite stable. The particles of a colloid do not separate out on keeping.
6. A colloid scatters a beam of light passing through it colloids cannot be separated by the process of filtration, but a special technique known as centrifugation can be used to separate the colloidal particles from a colloidal solution.

- **Classification of Colloids**

Colloids are classified according to the physical state of dispersed phase and the dispersion medium (solvent).

◈ **THE CLASSIFICATION OF COLLOIDS**

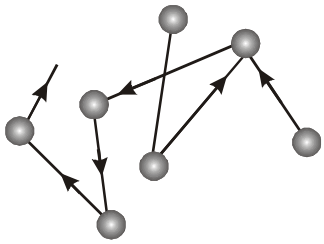
Technical name of colloid	Dispersed Phase	Dispersion medium	Examples
1. Sol.	Solid	Liquid	Ink, Soap solution, Starch solution, Most paints
2. Solid sol	Solid	Solid	Coloured gemstones (like Ruby glass)
3. Aerosol	(i) Solid	Gas	Smoke, Automobile exhausts
	(ii) Liquid	Gas	Hairspray, Fog, Mist, Clouds
4. Emulsion	Liquid	Liquid	Milk, Butter, Face cream
5. Foam	Gas	Liquid	Fire-extinguisher foam, Soap bubbles, Shaving cream, Beer foam
6. Solid foam	Gas	Solid	Insulating foam, Foam rubber, Sponge
7. Gel	Solid	Liquid	Jellies, Gelatine
	Continuous network of solid in liquid		



Butter is gel colloid.

	ON YOUR TIPS	
Colloid particles follow a zig-zag path. Such type of movement was noticed for the first time by Robert Brown, on English scientist, hence is called Brownian movement after his name.		

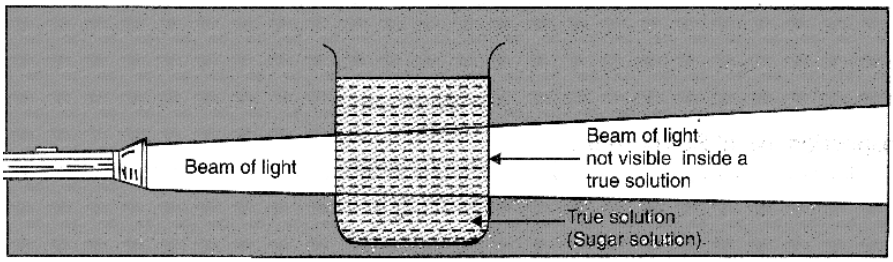
◈ BROWNIAN MOVEMENT OF COLLOIDS :-



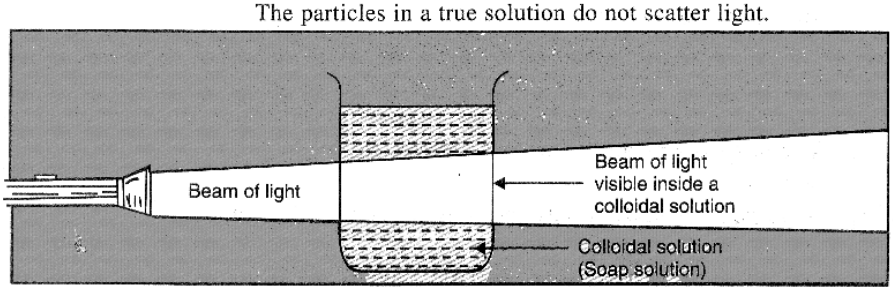
The colloidal particles are moving at random in a zigzag motion in all directions. This type of zig-zag motion of colloidal particles is called Brownian movement. This is shown figure. The brownian movement is caused by the collision (hitting) of the colloidal particle with the molecules of the dispersion medium.

Tyndall effect :

The phenomenon due to which the path of light becomes visible, due to scattering of light by the colloidal particle is called Tyndall effect.



The particles in a true solution do not scatter light.



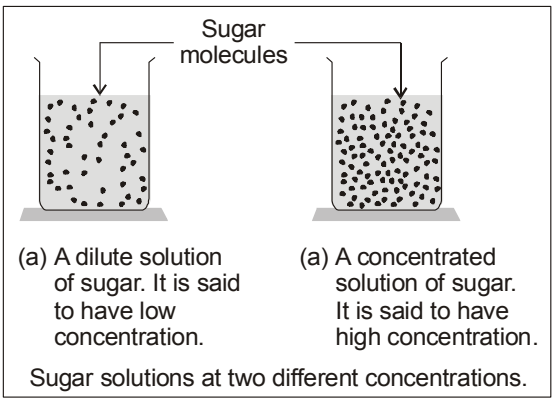
The particles in a colloidal solution (or colloid) scatter light.

Example :

- Tyndall effect can also be observed when a fine beam of light enters a room through a small hole. This happens due to the scattering of light by the particles of dust and smoke in the air.
- Tyndall effect can be observed when sunlight passes through the canopy of a dense forest. In the forest mist contains tiny droplets of water, which act as particles of colloids dispersed in air.

◈ CONCENTRATION OF SOLUITON

The concentration of a solution is the amount of solute present in a given quantity of the solution. The most common way of expressing the concentration of a solution is the 'percentage method'.



(a) A dilute solution of sugar. It is said to have low concentration.

(a) A concentrated solution of sugar. It is said to have high concentration.

Sugar solutions at two different concentrations.

The concentration of a solution is defined as the mass of solute in grams present in 100 grams of the solution. The concentration of a solution refers to the mass of solute in 100 grams of the solution and not in 100 grams of the solvent.

$$\text{Concentration of solution} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \quad 100$$

- **The Case of a Liquid Solute Dissolved in a Liquid Solvent**

The concentration of a solution is defined as the volume of solute in mililitres present in 100 mililitres of the solution. The concentration of solution refers to the volume of liquid solute in 100 mL of solution and not in 100 mL of solvent.

$$\text{Concentration of solution} = \frac{\text{Volume of solute}}{\text{Volume of solution}} \quad 100$$

SATURATED AND UNSATURATED SOLUTIONS

A solution in which more quantity of solute can be dissolved without raising its temperature, is called an unstaturated solution.

A Solution in which no more solute can be dissolved at that temperature, is called a saturated solution.

- **Effect of 'Heating' and 'Cooling' on a Saturated Solution**

If a saturated solution at a particular temperature is heated to a higher temperature, then it becomes unsaturated. Because the solubility of solute increases on heating. If a saturated solution available at a particular temperature is cooled to a lower temperature, then some of its dissolved solute will separate out in the form of solid crystals.

DIFFERENCE BETWEEN TRUE SOLUTIONS AND COLLOIDAL SOLUTIONS :

	True Solutions	Colloidal Solutions
1	The particle size is less than 10^{-7}cm	The particles size is in between 10^{-7} cm to 10^{-5} cm
2	The particles are not visible under powerful microscope.	The particles are visible under microscope.
3	The particle of a true solution can be recovered by evaporation and crystallisation.	The particles of a colloidal solution cannot be recovered by evaporation and crystallisation
4	The particles of a true solution do not scatter light	The particles of a colloidal solution scatter light
5	True solutions are clear and transparent	Colloidal solutions are translucent

DIFFERENCE BETWEEN COLLOIDAL SOLUTIONS AND SUSPENSIONS :

	Colloidal Solutions		Suspension
1	The size of particles of solute is in between 10^{-7} cm to 10^{-5} cm.	1	The size of particles of solute is more than 10^{-5} cm
2	The particles of solute do not settle down when a colloidal solution is allowed to stand	2	The particles of suspension settle down when a suspension is allowed to stand
3	The particles of solute cannot be filtered out	3	The particles of suspension can easily be filtered out

ON YOUR TIPS

Heterogeneous mixture can be separated into their respective components by simple physical methods such as handpicking, sieving, filtration etc. in every day life. However, for separating homogeneous mixtures special techniques are employed depending upon the difference in one or more properties.

SOLUBILITY

The maximum amount of a solute which can be dissolved in 100 grams of a solvent at a specified temperature is known as the solubility of that solute in that solvent (at the temperature).For example: A maximum of 32 grams of potassium nitrate can be dissolved in 100 grams of water at 20ºC, therefore, the solubility of potassium nitrate in water is 32 grams at 20ºC.

Substance (or Solute)	Solubility in water (at 20ºC)
1. Copper sulphate	21 g
2. Potassium nitrate	32 g
3. Potassium chloride	34 g
4. Sodium chloride	36 g
5. Ammonium chloride	37 g

PHYSICAL AND CHEMICAL CHANGES

- **Physical Changes**

  Those changes in which no new substances are formed, are called physical changes. Some common examples of physical changes are : Melting of Ice, Freezing of water, Boiling of water, Condensation of steam, Making a solution, Glowing of an electric bulb and Breaking of a glass tumbler.

  The physical changes are temporary changes which can be reversed easily to form the original substance.

- **Chemical Changes**

  Those changes in which new substances are formed, are called chemical changes. Some common examples of chemical changes are : Burning of a magnesium wire ; Burning of paper ; Rusting of iron ; Formation of curd from milk ; and Cooking of food.

◈ PHYSICAL CHANGE

1. No new substance is formed in a physical change.
2. A physical change is a temporary change.
3. A physical change is easily reversible.
4. Very little heat (or light) energy is usually absorbed or given out in a physical change.
5. The mass of a substance does not alter in a physical change.

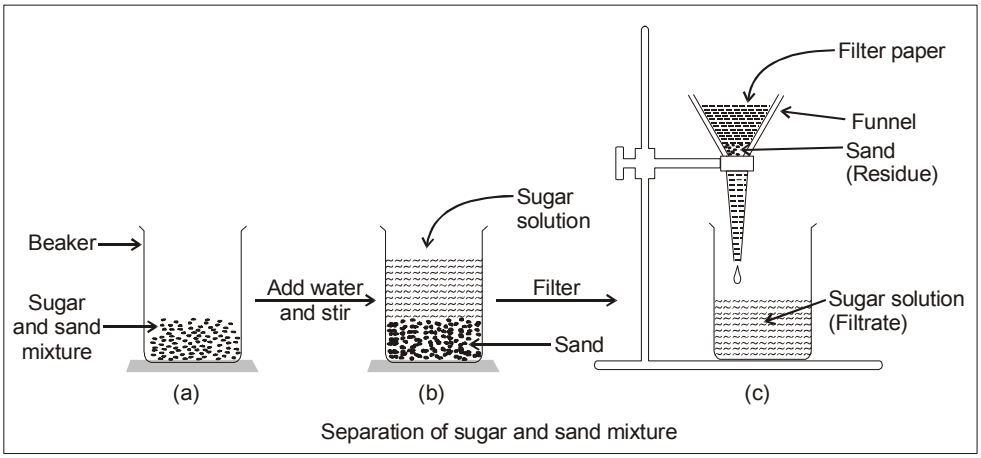
◈ CHEMICAL CHANGE

1. A new substance is formed in a chemical change.
2. A chemical change is a permanent change.
3. A chemical change is usually irreversible.
4. A lot of heat (or light) energy is absorbed or given out in a chemical change.
5. The mass of a substance does alter in a chemical change.

SEPARATION OF MIXTURE OF TWO SOLIDS

1. Separation by a Suitable Solvent

A mixture of sugar and sand can be separated by using water as solvent. The mixture of sugar and sand is taken in a beaker and water is added to it. The mixture is stirred to dissolve the sugar in water. The sand remains undissolved.



Separation of sugar and sand mixture

	ON YOUR TIPS	
Magnetic separation can be used to separate the components from a mixture if one of them is of magnetic nature while the other is non-magnetic.		

The sugar solution containing sand is filtered by pouring over a filter paper kept in a funnel.

- **To Separate a Mixture of Sulphur and Sand**

A mixture of sulphur and sand can be separated by using carbon disulphide as solvent.

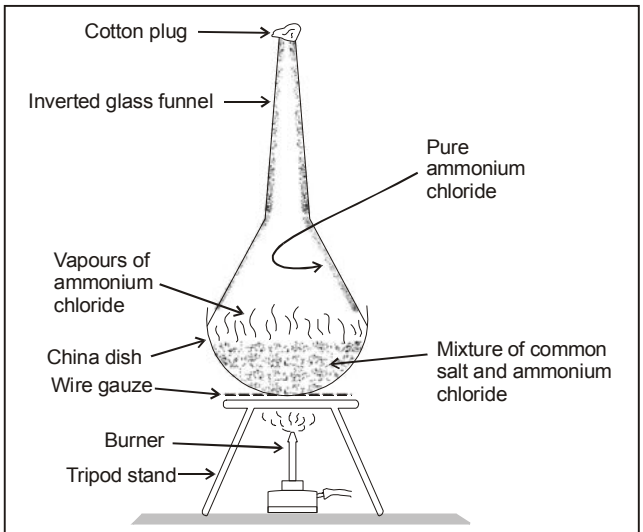
2. Separation by Sublimation

The changing of a solid directly into vapours on heating, and of vapours into solid on cooling is called sublimation.

- **To Separate a Mixture of Common Salt and Ammonium Chloride**

We can separate ammonium chloride from a mixture of 'common salt and ammonium chloride' by the process of sublimation.

The mixture of common salt and ammonium chloride is taken in a china dish. The china dish is covered with an inverted glass funnel. A loose cotton plug is put in the upper, open end of the funnel to prevent the ammonium chloride vapours from escaping into the atmosphere. On heating the mixture, ammonium chloride changes into white vapours. These vapours rise up and get converted into solid ammonium chloride on coming in contact with the cold, inner walls of the funnel. Pure ammonium chloride collects on the inner sides of the funnel in the form of a sublimate and can be removed.



Separation of a mixture by sublimation. Here a mixture of common salt and ammonium chloride is being separated by sublimation.

3. Separation by a Magnet

If a mixture contains iron as one of the constituents, it can be separated by using a magnet. For example, a mixture of iron fillings and sulphur powder can be separated by using a magnet.

- **Separation of Scrap Iron**

In factories, scrap iron is separated from the heap of waste materials by using big electromagnets fitted to a crane.

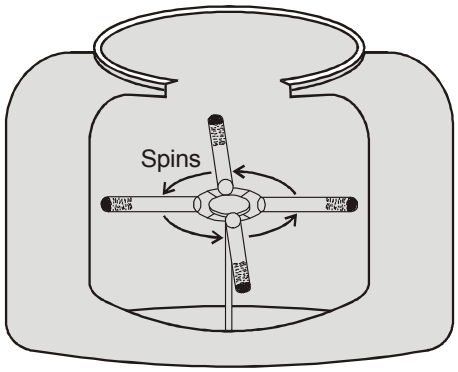
SEPARATION OF MIXTURE OF A SOLID AND A LIQUID

1. Separation by Filtration

Filtration is used for separating insoluble substances from a liquid. A mixture of chalk and water is separated by filtration. When the mixture of chalk and water is poured on the filter paper fixed in a funnel, then clear water passes through the filter paper and collects as filtrate. The chalk particles remain behind on filter paper as residue.

2. Separation by Centrifugation

Centrifugation is a method for separating the suspended particles of a substance from a liquid in which the mixture is rotated at a high speed in a centrifuge.



This is a centrifuge. A centrifuge is used to separate suspended solid particles from a liquid, quickly. When the centrifuge is switched on, the test-tubes (containing suspension) held in it swing out and spin (or rotate) at high speed. The centrifugal force acts on suspended particles which forces them to go to the bottom of test-tubes and clear liquid remains on top (This sketch shows four test-tubes spinning at the same (time).

- **Separation of Cream from Milk**

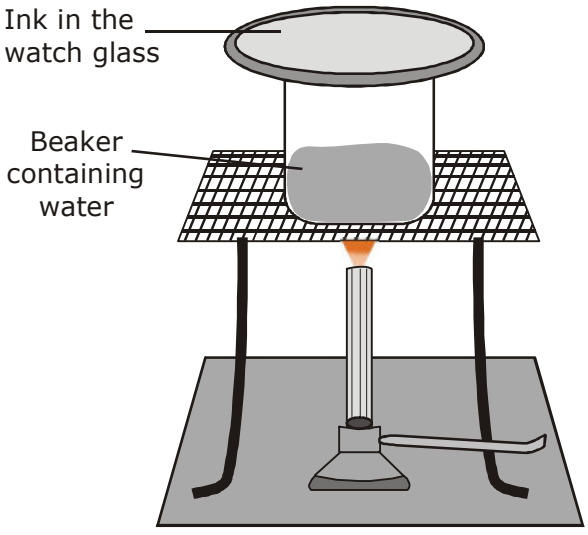
The process of centrifugation is used in dairies to separate cream from milk. The milk is put in a closed container in big centrifuge machine. When the centrifuge machine is switched on, the milk is rotated. Due to this, the milk separates into 'cream' and 'skimmed milk'. Thus, cream is separated from milk by centrifugation.

Milk churner

3. Separation by Evaporation

Evaporation is used to separate a solid substance that has dissolved in water. The use of process of evaporation for separating a mixture is based on the fact that liquids vaporise easily whereas solids do not vaporise easily.

The common salt dissolved in water can be separated by the process of evaporation. The solution of common salt and water is taken in a china dish and heated gently by using a burner. The water present in salt solution will form water vapours and escape into atmosphere. The process of evaporation is used on a large scale to obtain common salt from sea-water.



Evaporation

4. Purification by Crystallisation

The process of cooling a hot, concentrated solution of a substance to obtain crystals is called crystallisation.

Crystallisation is a better technique than 'evaporation to dryness' because of the following reasons :

(i) Some solids (like sugar) decompose or get charred on heating to dryness during evaporation. There is no such problem in crystallisation.

(ii) The soluble impurities do not get removed in the process of evaporation. But such impurities get removed in crystallisation.

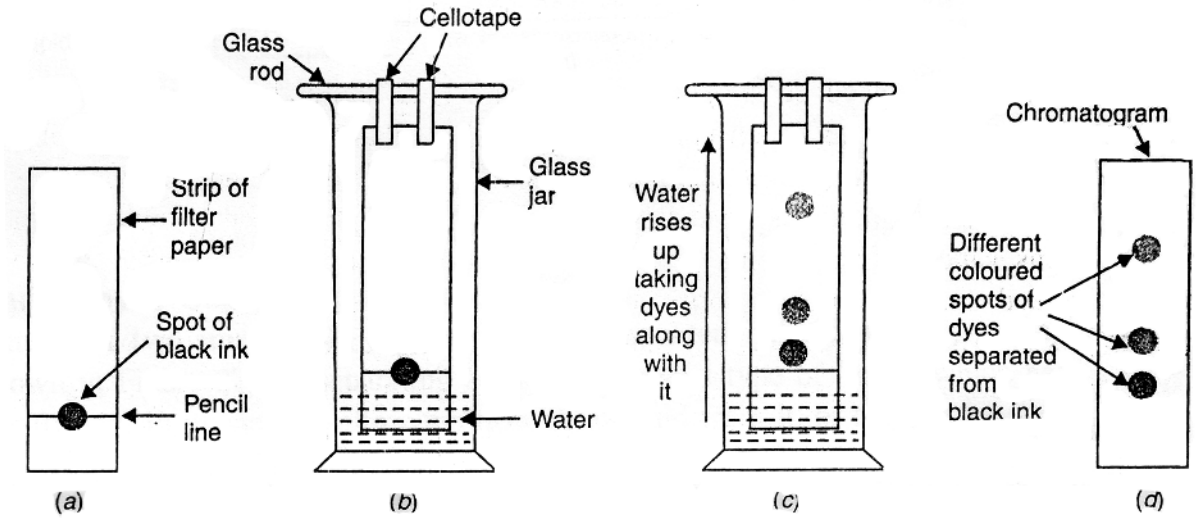
5. Separation by Chromatography

Chromatography is a technique of separating two (or more) dissolved solids which are present in a solution in very small quantities. There are many types of chromatography but the simplest form is the paper chromatography. By using paper chromatography, we can separate two (or more) different substances present in the same solution.

ON YOUR TIPS
Kroma in Greek means colour. There are many types of chromatography like gas chromatography, liquid chromatography etc. but the simplest form is the paper chromatography.

ON YOUR TIPS
Paper chromatography is very useful in separating various constituents of coloured solutes present in a mixture like, ink, dyes etc.

- **To Separate the Dyes Present in Black Ink**



Separation of the 'dyes' in black ink by paper chromatography.

1. Take a thin and long strip of filter paper. Draw a pencil line on it. about 3 centimetres from one end.
2. Put a small drop of black ink on the filter paper strip at the centre of the pencil line.
3. When the drop of ink has dried, the filter paper strip is lowered into a tall glass jar containing some water in its lower part. The lower end of the paper strip should dip in water but the pencil line should remain above the water level in the jar.

4. The water gradually rises up the filter paper strip by capillary action. The dye which is more soluble in water dissolves first, rises faster and produces a coloured spot on the paper at a higher position. In this way, all the dyes present in black ink get separated (by forming separate different coloured spots).

The paper which its separate coloured spots is called a chromatogram the important application (or uses) of chromatography :

(i) Chromatography is used to separate solutions of coloured substances.

(ii) Chromatography is used in forensic science to detect and identify trace amounts of substances in the contents of bladder or stomach.

(iii) Chromatography is used to separate small amounts of products of chemical reactions.

6. Separation by Distillation

In order to recover both, salt as well as water, from a salt-water mixture (or salt solution), the process of distillation is used.

Distillation is the process of heating a liquid to form vapour, and then cooling the vapour to get back liquid. Distillation can be represented as :

$$\text{Liquid} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} \text{Vapour (or gas)}$$

Pure water or distilled water is made from tap water by the process of distillation.

SEPARATION OF MIXTURE OF TWO (OR MORE) LIQUIDS

All the mixtures containing two (or more) liquids can be separated by one of the following two methods:

(i) By the process of fractional distillation.

(ii) By using a separating funnel.

Those liquids which mix together in all proportions and form a single layer (when put in a container), are called miscible liquids. Alcohol and water are miscible liquids. A mixture of miscible liquids is separated by the process of fractional distillation.

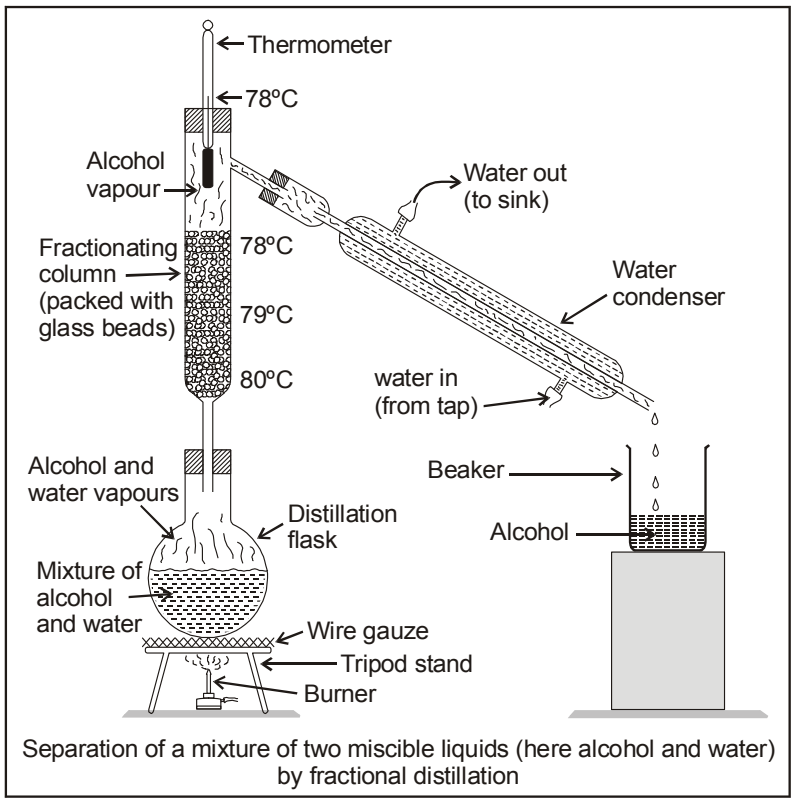
Those liquids which do not mix with each other and form separate layers (when put in a container), are called immiscible liquids.

A mixture of immiscib le liquids is separated by using an apparatus called separating funnel.

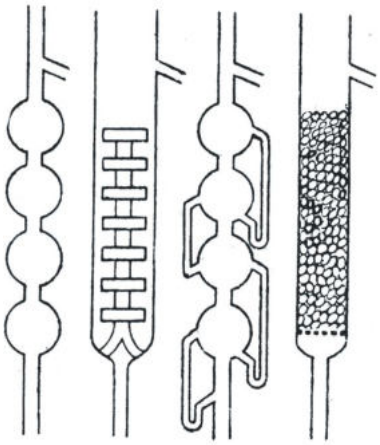
1. Separation by Fractional Distillation

Fractional distillation is the process of separating two (or more) miscible liquids by distillation, the distillate being collected in fractions boiling at different temperatures. The separation of two liquids by fractional distillation depends on the difference in their boiling points. Fractional distillation is carried out by using a fractionating column.

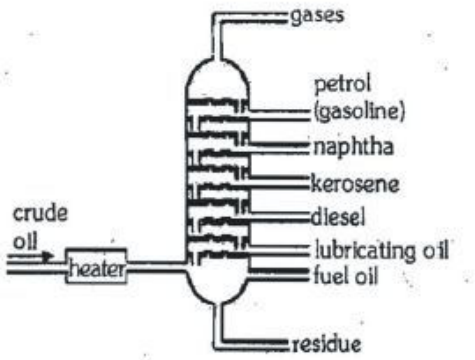
In most simple terms, a fractionation column can be regarded as an arrangement for providing differnet temperature zones inside it (during distillation), the highest temperature being at the bottom of the column and the lowest temperature near its top.



Separation of a mixture of two miscible liquids (here alcohol and water) by fractional distillation



Different types of fractionating column



Petroleum products are also separated by fractional distillation

	ON YOUR TIPS	✓

A fractionating column is a long tube provided with obstruction to the passage of vapours upwards and that to liquid downwards.

	ON YOUR TIPS	✓

A simple fractionating column is a long vertical glass tube filled with glass beads The glass beads provide a large surface area for hot vapours to cool and condense respectively.

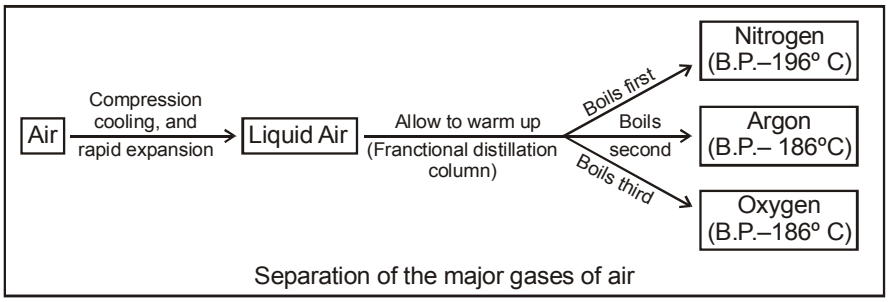
- **Applications of Fractional Distillation**

1. Fractional distillation is used to separate mixtures of miscible liquids (like alcohol-water mixture and acetone-water mixture) in the laboratory.
2. Fractional distillation is used to separate crude oil 'petroleum' into useful fractions such as kerosene, petrol and diesel, etc.
3. Fractional distillation (of liquid air) is used to separate gases of the air.

- **Separation of the Gases of the Air**

The various gases of air are separated from one another by the fractional distillation of liquid air. This separation is based on the fact that the different gases of air have different boiling points.

Gas	Boiling point (of liquefied gas)
Nitrogen	-196°C (Lowest boiling point)
Argon	-186°C
Oxygen	-183°C (Highest boiling point)



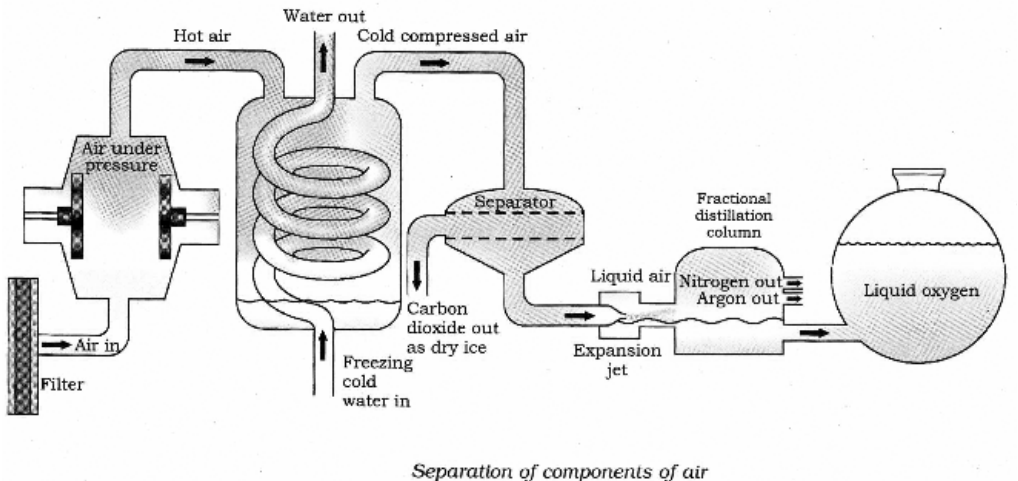
Separation of the major gases of air

ON YOUR TIPS

The earth's crust is mode mainly from two elements i.e. oxygen (46.6%) & silicon (27.7%). The rest of the elements are present in lesser proportions. All living things, both plants & animals are made from a few elements only. These are mainly oxygen carbon, hydrogen, nitrogen, calcium along with same other elements.

ON YOUR TIPS

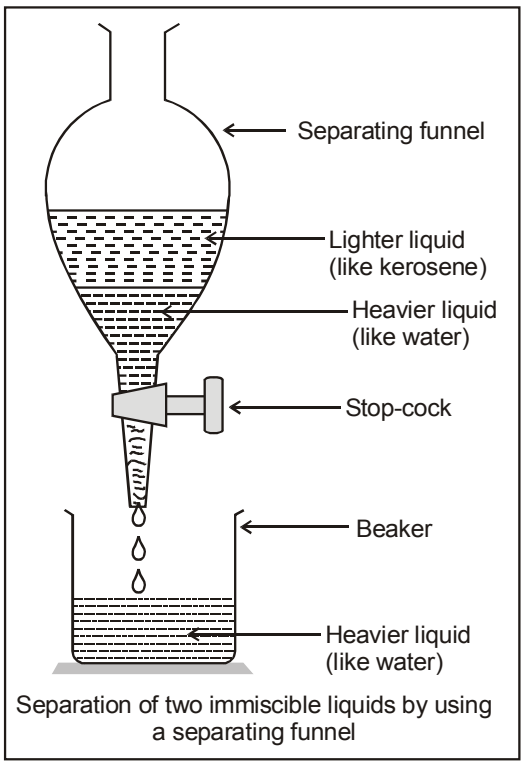
The major component of air is nitrogen [78.03%]. The second major component of air is oxygen [20.99%] and the third major component of air is argon [0.93%].



Separation of components of air

2. Separation by a Separating Funnel

A mixture of two immiscible luqids can be separated by using a separating funnel. The separation of two immiscible liquids by a separating funnel depends on the difference in their densities. A mixture of water and kerosene can be separated by using a separating funnel.



Separation of two immiscible liquids by using a separating funnel

ON YOUR TIPS

Please note that water and alcohol form a homogeneous mixture and hence cannot be separated by using a separating funnel.

A mixture of petrol and water can also be separated by using a separating funnel. A mixture of more than two immiscible liquids can also be separated by using a separating funnel.

CRYSTALLISATION

The process of cooling a hot, concentrated solution of a substance to obtain crystals is called crystallisation. Crystallisation is a process that separates a pure solid in the form of its cyrstals from a solution.

Methods :

- We take about 10 grams of impure copper sulphate and dissolve it in minimum amount of water in a china dish to make copper sulphate solution.
- Filter the copper sulphate solution to remove insoluble impurities.
- Heat the copper sulphate solution gently on a water bath to evaporate water and obtain a saturated solution. This can be tested by dipping a glass rod in hot solution from time to time. When small crystals form on the glass rod, the solution is saturated. Then stop heating.
- Allow the hot, saturated solution of copper sulphate to cool slowly.
- Crystals of pure copper sulphates are formed, impurities remains behind in the solution.
- Separate the copper sulphate crystals from solution by filtration and dry.
- Crystallisation is a better technique than evaporation to dryness because of following reasons.

(i) Some solids decompose or get charred on heating to dryness during evaporation.

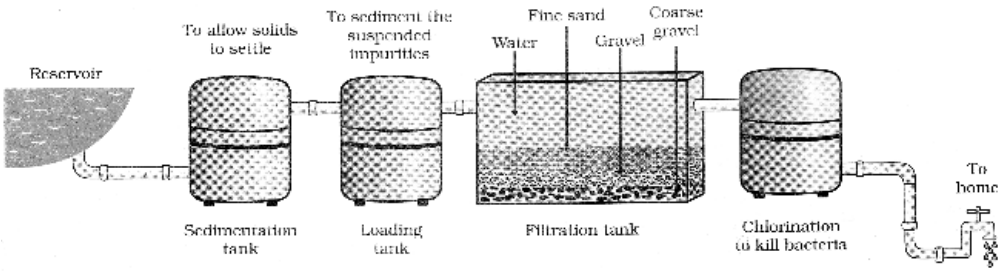
(ii) The soluble impurities do not get removed in the process of evaporation. But such impurities get removed in crystallisation.

Application :

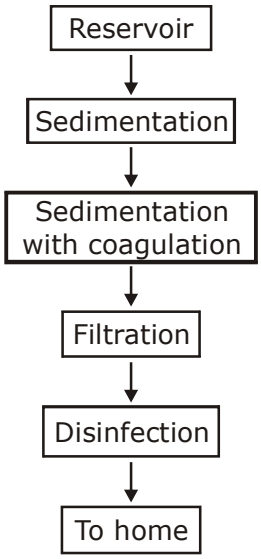
- Purification of salt that we get from sea water
- Separation of crystals of alum (phitkari) from impure samples.

Supply of drinking water in a city :

In cities, drinking water is supplied from water works. In water works, the methods like sedimentation, decantation, loading, filtration and chlorination etc are used to remove undesirable materials from water. The source of water supply in a city is either a nearby river or a lake called reservoir. The river water and lake water usually contain suspended solid substances and some germs, so, before this water can be supplied to homes, it must be purified to remove suspended impurities as well as germs.



Water purification system in water works



Municipal water supply

The purification of river water or lake water is done in the following steps.

(1) **Sedimentation :** The water is allowed to stand in big tanks, where heavier suspended impurities settle down. To increase the rate of sedimentation, alum is added to it. The impurities settle at the bottom.

(2) **Filtration :** The semi-clear water is allowed to pass through beds of sand, charcoal and gravel to remove suspended impurities.

(3) **Removal of harmful** - **organism or sterilisation :** The harmful bacteria in filtered water can cause very serious diseases such as typhoid, cholera etc. Thus, to the filtered water bleaching powder or chlorine gas is added. This kills the micro-organism and hence the water becomes fit for drinking. This water is directly pupmed into overhead tanks for supply to a city.

SOLVED PROBLEMS

Ex.1 Choose the elements, mixture and compounds.
(i) Brass (ii) Diamond (iii) Sand.

Sol. (i) Brass is a mixture.
(ii) Diamond is an element (it is an allotrope of carbon which is made up of carbon atoms only.)
(iii) Sand is a compound.

Ex.2 Classify each of the following as element, compound or mixture
Gold, Air, Marble, Milk, Sugar

Sol. Element $\longrightarrow$ Gold
Compound $\longrightarrow$ Marble, Sugar
Mixture $\longrightarrow$ Air, Milk.

Ex.3 What is a solution ?

Sol. A solution is a homogeneous mixture of two or more substances.

Ex.4 How can we obtain coloured component (dye) from Blue/Black ink?

Sol. By evaporation method, we can separate dye (solid) from liquid (solvent) and by chromatography method, we can separate components of the dye.

Ex.5 How can we separate cream from milk?

Sol. By centrifugation.

Ex.6 Define (a) solute (b) solvent.

Sol. (a) Solute : A small amount of substance which dissolves in another substance. (called solvent) is called the solute.
(b) Solvent - A larger proportion component of a solution.

Ex.7 What is a mixture ? Name two types of mixtures.

Sol. (a) Mixture is a product formed by mixing two or more substances in any proportion and constituents of a mixture do not undergo any chemical change, but they retain their properties.
(b) Depending upon the nature of the components that form a mixture, we have different types of mixtures.
(i) Homogeneous mixture.
(ii) Heterogeneous mixture.

Ex.8 Define an alloy ? Why an alloy is considered as a mixture ?

Sol. (a) An alloy is a homogeneous mixtures of metals and cannot be separated into their components by physical methods.
(b) An alloy is considered as a mixture because it shows the properties of its constituents and can have variable composition.

Ex.9 What is a concentration of a solution ?

Sol. The concentration of a solution is the amount of solute present in a given amount (mass or volume) of solution, or the amount of solute dissolved in a given mass or volume of a solvent.
Concentration of solution = Amount of solute / Amount of solution

OR

Amount of solute / Amount of solvent.

Ex.10 A solution contains 40g of common salt in 320 g of water. Calculate the concentration in terms of mass by mass percentage of the solution.

Sol. Mass of solute (salt) = 40g,

Mass of solvent (water) = 320g

We know,

Mass of solution = Mass of solute + Mass of solvent

= 40g + 320 g = 360 g

Mass percentage of solution

$$= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$= \frac{40}{360} \times 100 = 11.1\%$$

Ex.11 Which of the following matter falls in the category of a "substance" ?

(a) Ice (b) Milk

(c) Iron (d) Hydrochloric acid(HCl)

(e) Calcium oxide (CaO) (f) Mercury

(g) Brick (h) Wood (i) Air

Sol. A substance in science is a single pure form of matter and not a mixture of several different kinds of matter. Therefore, Ice, Iron, Hydrochloric acid (HCl), Calcium oxide (CaO) and Mercury are categorised as substances as these cannot be separated into their constituents by simple physical process of distillation and evaporation.

Ex.12 What is the difference between aqueous solution and non-aqueous solution ? Give one example of each.

Sol.

Aqueous Solution	Non-aqueous Solution
1. Solutions prepared in water are called aqueous solutions.	1. The solutions formed by dissolving substances in liquids like - alcohol, acetone and carbon disulphide are called non-aqueous solutions.
2. These solutions ionize easily and hence can conduct electricity. e.g. solution of sodium chloride; solution of sugar.	2. These solutions do not ionize and therefore do not conduct electricity. e.g. solution of sulphur dissolved in carbon disulphide; solution of iodine dissolved in alcohol.

Ex13. Differentiate between a saturated and unsaturated solution. How will you test whether a given solution is saturated or not.

Sol.

Saturated Solution	Unsaturated Solution
1. It is a solution in which no more solute can be dissolved at a given temperature.	1. It is a solution in which more amount of solute can be dissolved without raising the temperature.
2. When temperature of saturated solution is decreased then the solute starts separating from the solution in the form of crystalline solid.	2. When temperature of unsaturated solution is decreased then it becomes saturated.

If we add more solute to a solution and it gets dissolved then the solution is unsaturated. If it does not dissolve, then the solution is saturated.

Ex.14 Given a solution of substance A', how will you test whether it is saturated or unsaturated with respect to 'A, at the prevailing temperature? What is observed when a hot saturated solution of a substance is allowed to cool ?

Sol. When no more substance 'A' can be dissolved in the solution at a given temperature, then the solution is saturated with respect to substance 'A'. When a hot saturated solution of a substance is allowed to cool, crystals of substance separates out from the solution.

Ex.15 Differentiate between true solution and colloidal solution.

Sol.

True solution	Colloidal Solution
1. Size of solute particles is 10^{-8} cm.	1. Size of solute particles is between 10^{-7} cm and 10^{-5} cm.
2. It is homogeneous mixture.	1. It appears to be homogeneous but actually is heterogeneous.
3. It does not scatter light. e.g. : Salt solution, sugar solution.	1. It scatters a beam of light when light is passed through it and makes its path visible (tyndall effect). e.g. Milk, blood, starch solution

Ex.16 40 g of sugar is dissolved in 250 ml of solution. Calculate the concentration of the solution in terms of mass by volume percentage of solution.

Sol. Mass of sugar = 40 g

Vol. of solution = 250 ml

$\therefore$ Mass by volume percentage of solution = $\frac{40}{250}$ 100 = 16%.

Ex.17 What is a suspension ?

Sol. A suspension is a heterogeneous mixture of a solid in a liquid. A suspension is formed when a liquid contains small solid particles which are not soluble in it but are visible to naked eyes. If such a mixture is left undisturbed, the solid particles slowly settle down to the bottom under the effect of gravity. If the particle size of the solid is greater than 10^{-7} suspended in the liquid. This is called a suspension. For example, mud water, sand water, coarse lime stone particles in water.

Ex.18 What are colloidal solutions ? Give examples.

Sol. A colloidal solution is said to be intermediate state of the solution and the suspension. It is neither a true solution nor a suspension. In colloidal solution, the particle size is between 1 nm to 100 nm. For example, a solution of soap in water, milk, blood, writing inks are some of the colloidal solutions. Though these particles are 10 to 1000 times the size of a single small molecule, these are not visible to naked eyes. But these are large enough to scatter the light that passes through the dispersion medium. The medium of colloidal solution is known as dispersion phase (dispersion medium) and the particles dissolved are called dispersed phase. In milk, water is dispersion phase and fats, proteins etc. are dispersed phase. In fog, water droplets form the dispersed phase and air is dispersing medium.

Ex.19 What is Tyndall effect ? Why is Tyndall effect observed when sun light passes through dense forest.

Sol. The illumination of beam of light due to scattering on collision with certain particles is called Tyndall effect.

In dense forest, particularly in the early morning, there is fog, i.e., tiny water droplets suspended in air. These droplets are large enough to scatter beam of light. This is why Tyndall effect can be observed when sunlight passes through dense forest.

Ex.20 What types of mixtures can be separated by simple distillation ?

Sol. Simple distillation can be used to separate the following mixtures :

(a) Two miscible liquids that boil without decomposition and have sufficient difference (> 20ºC) in their boiling points.

(b) A mixture/solution of a solid in a liquid.

NCERT QUESTIONS WITH SOLUTIONS

Q.1 What is meant by a pure substance?

Ans. A pure substance Is one that cannot be separated into different constituents by physical or chemical process. A pure substance is one that contains particles of only one type of a substance.

Q.2 Ust the points of differences between homogeneous and heterogeneous mixtures.

Ans. **Homogeneous mixture :**

(i) The composition of a homogeneous mixture is the same throughout. For example, if you make a solution of sugar in water and taste it by taking a spoonful of solution either from the surface or from somewhere underneath the surface, it tastes equally sweet.

(ii) A homogeneous mixture has no distinct boundaries, i.e., it consists of only one phase which may be solid, liquids or gaseous. For example, alloys such as brass (30% zinc and 70% copper) is a homogeneous mixture in the solid state. A soiution of sugar or common salt in water is homogeneous mixture in the liquid state. Similarly, a solution of water and alcohol is a homogeneous mixture in the liquid state. Pure air (without dust particles and suspended impurities) is a homogeneouS mixture in the gaseous state.

Heterogeneous mixture :

(i) The composition of a heterogeneous mixture is not the same throughout. For example, if we prepare a mixture of starch and sugar by thoroughly grinding it and taste it by picking up a few particles from the various portions of the mixture, it will not have the same sweetness.

(ii) A hetetogeneous mixture has distinct boundaries d separation, i.e., itconslsts of two or more phases which can either be solids or liquids but not gaseous. For example, iron fiilings (greyish in colour) and sulphur powder (yellow) on mixing form a heterogeneous mixture (greyish yellow). When we examine this mixture under a microscope, we clearly see that every small portion of the mixture consists of two solid phases -one of greyish colour consisting of iron filings and the other of yellow.colour consisting of sulphur powder. Similarly, a mixture of oil in water isf.eterogeneous mixture, consisting of two liquid phases -one of oil and the other of water. In other words, oil in water has a distinct boundary separating oil from water.

Q.3 Differentiate between homogeneous and heterogeneous mixtures with examples.

Ans. **Homogeneous mixture :**

They have uniform compositions. The components of homogeneous mixtures are not physically distinct. Most solutions are homogeneous mixtures. Salt in water, sugar in water are examples of homogeneous mixtures.

Heterogeneous mixture :

They contain physically distinct parts and have non-uniform compositions. Mixtures of sodium chloride and iron filings, salt and sulphur, and oil and water are examples of heterogeneous mixtures. Suspensions and colloids are also heterogeneous mixtures.

Q.4 To make a saturated solution, 36 9 of sodium chloride is dissolved in 100 9 of water at 293 K. Find its concentration at this temperature.

Ans. $\text{Concentration} = \dfrac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

Here, mass of solute = 36 g

and mass of solvent = 100g

Therefore, Mass of solution = 100 + 36 = 136 g

Thus, concentration $= \dfrac{36}{136} \times 100 = 26.47\%$

Q.5 How will you separate a mixture containing kerosene and petrol (difference in their boiling points is more than 25°C), which are miscible with each other.

Ans. The process of distillation is used for the separation of components of a mixture containing two miscible liquids that boil without decomposition and have sufficient difference in their boiling points (that is greater than 25°C).

Q.6 Name the technique to separate,

(i) Butter from curd, (ii)Salt from sea-water, (iii) Camphor from salt.

Ans. (i) Centrifugation (ii) Evaporation (iii) Sublimation

Q.7 What type of mixtures qre separated by the technique of crystallisation?

Ans. The crystallisation method is used to purify solid § mixtures.

Q.8 Classify the following as chemical or physical changes :

- Cutting of trees
- Melting of butter in a pan
- Rusting of almirah
- Boiling of welter to form steam
- Passing of electric current through water and the water breaking down Into hydrogen and oxygen gases
- Dissolving common salt in water
- Making a fruit salad with raw fruits, and
- Burning of paper and wood.

Ans. Physical changes: Cutting of trees, melting of butter in a pan, boiling water to form steam, making a fruit salad with row fruits, dissolving common salt in water.

Chemical changes: Rusting of almirah, passing of electric current through water and the water breaking down into hydrogen and oxygen gases, burning of paper and wood.

Q.9 Try segregating the things around you as pure substances or mixtures: (a) distilled water (b) curd (c) diamond (d) ice-cream (e) kerosene oil (f) cooking oil (g) steel (h) graphite (i) raw rubber (j) wlcanized rubber (k) solder wire (ℓ) glass (m) iron nail.

Ans. (i) Pure substance: Water, glass, iron nail, graphite, diamond, raw rubber.

(ii) Mixture: curd, ice cream, kerosene oil, cooking oil, steel, vulcanized rubber, solder wire.

Q.10 Which separation techniques win you apply for the separation of the following?

(a) Sodium chloride from its solution in water.

(b) Ammonium chloride from a mixture containing sodium chloride a'nd ammonium chloride.

(c) Small piece of metal in the engine oil of a car.

(d) Different pigments from an extract of flower petals.

(e) Butter from curd.

(f) Oil from curd.

(g) Tea leaves from tea

(h) Iron pins from sand.

(i) Wheat grains from husk.

(j) Fine mud particles suspended in water.

Ans. (a) Evaporation (b) Sublimation (c) Filtration (d) Chromatography

(e) Centrifugation (f) Distillation (g) Sieving (h) Magnetic separation

(i) Sieving and winnowing (j) Sedimentation, decantation and filtration.

Q.11 Write the. steps you would use for making tea. Use the words solUtion, solvent, solute, dissolve, soluble, insoluble, filtrate and residue.

Ans. Take some water in pan. Keep the pan over flame. Add sugar and tea leaves, which are solute in the water in the pan, which is the solvent. Heat the water over the pan till the sugar, which is soluble in water dissolves in it. Tea leaves are insoluble in water and wiU remain suspended. Now add water to the sugar and tea leaves solution and bring the mixture to a boil. Filter the prepared tea through a sieve. Filtrate should be poured in a cup, while the residue can be thrown away.

Q.12 Pragya tested the solubility of three different substances at different temperatures and coUected the data as given below. Result are given in the following table, as grams of.substance dissolved in 100 grams of water to form a saturated solution.

substance Dissolved	Temperature in K				
	283	293	313	333	353
Potassium nitrate	21	32	62	106	167
Sodium chloride	36	36	36	37	37
Potassium chloride	35	35	40	46	54
Ammonium chloride	24	37	41	55	66

(a) Potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 grams of water at 313 K ?

(b) Pragya makes a saturated solution of potassium chloride in water at 353 K and leaves the solution to cool at room temperature. What would she observe as the solution cools?

(c) Explain. Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature ?

(d) What is the effect of change of temperature on the solubility of a salt ?

Ans. (a) Since 62 9 of potassium nitrate is dissolved in 100 9 of water to prepre a saturaterd solutior at 313 K, 31 g of potassium nitrate should be dissolved in 50 g of water to prepare a saturated solution at 313 K.

(b) The amount of potassium chloride that should be dissolved in water to make a saturated solution increases with temeprature. Thus, as the solution cools some of the potassium chloride will precipitate out of the solution.

(c) The solubility of the salt at 293 K are
Potassium nitrate - 32 g
Sodium chloride - 36 g
Potassium chloride - 35 g
Ammonium chloride - 37 g
Ammonium chloride has the highest solubility at 293 K.

(d) The solubility of a salt increases with temperature.

Q.13 Explain the following by giving examples.
(a) Saturated solution (b) Pure substance (c) Colloid (d) Suspension

Ans. (a) At any particular temerature, a solution that has dissolved as much solute as it is capable of dissolving is said to be saturated solution. Few examples of saturated solutions are soft drinks and nitrogen in Earth's soil.

(b) A pure substance is one that cannot be separated into different constituents by physical or chemical processes. A pure substance is one that contains particles of only one type of a substance. Pure substance can be elements or compounds. Some examples of pure substances are iron, water, oxygen, etc.

(c) Colloids are heterogeneous mixtures in whiCh the particle size is too small to be seen with the naked eye, but is big enough to scatter light. Smoke, paint, butter are few examples of colloids.

(d) Materials that are insoluble in a solvent and have particles that are visible to naked eyes form a suspension. A suspension is a heterogeneous mixture. Some examples of suspension are water with chalk particles, sandy water and water with stones.

Q.14 Classify each of the following as a homogeneous or heterogeneous mixture.
Soda, water, wood, air, soil, vinegar, filtered tea.

Ans. **Homogeneous -** soda, water, air, vinegar, filtered tea.
Heterogeneous - wood, soil.

Q.15 How would you confirm that a colourless liquid given to you is pure water?

Ans. If the boiling and freezing points of the given liquid comes out to be 100°C and 0°C respectively under one atmosphere pressure, it confirms that the given liquid is pure water.

Q.16 Identify the solution among the following mixtures.
(a) Soil (b) Sea water (c) Air (d) Coal (e) Soda water.

Ans. Sea water, air, and soda water are solutions.

Q.17 Which of the following will show "Tyndall effect"?
(a) Salt solution (b) Milk
(c) Copper sulphate solution (d) Starch solution

Ans. Colloids show Tyndall effect, Milk is a colloid. Thus, it will show Tyndall effect. Therefore the correct answer is (b).

Q.18 Classify the following into elements, compounds and mixtures.
(a) Sodium (b) Soil (c) Sugar solution (d) Silver (e) Calcium carbonate
(f) Tin (g) Silicon (h) Coal (i) Air (j) Soap
(k) Methane (ℓ) Carbon dioxide (m) Blood

Ans. **Elements:** sodium, silver, tin and silicon
Compounds: calcium carbonate, soap, methane and carbon dioxide.
Mixtures: soil, sugar solution, coal, air and blood.

Q.19 Which of the following are chemical changes?
(a) Growth of a plant (b) Rusting of iron
(c) Mixxing of iron filings and sand (d) Cooking of food
(e) Digestion of food (f) Freezing of water
(g) Burning of a candle

Ans. Rusting of iron, cooking of food, digestion of food, and burning of candle are chemical changes.

EXERCISE – I BOARD PROBLEMS

Q. 1 What would you observe when

(a) a saturated solution of potassium chloride prepared at 60ºC is allowed to cool to room Temperature.

(b) an aqueous sugar solution is heated to dryness

(c) a mixture of iron filings and sulphur powder is heated strongly.

Q. 2 A child wanted to separate the mixture of dyes constituting a sample of link. He marked a line with the link on a filter paper and placed the filter paper in a glass containing water as shown

In the figure. The filter paper was removed when the water moved near the top of the filter paper.

(a) What would you expect to see, if the ink contains three different coloured components?

(b) Name the technique used by the child.

(c) Suggest one more application of this technique.

Q.3 (a Under which category of mixtures will you classify alloys and why ?

(b) A solution is always a liquid. Comment.

(c) Can a solution be heterogeneous ?

Q.4 On heating calcium carbonate gets converted to calcium oxide and carbon dioxide.

(a) Is this a physical or a chemical change

(b) Can you prepare one acidic and one basicsolution by using the products formed in the above process ? If so, write the chemical equation involved.

Q.5 Give three differences between a colloidal solution and a true solution.

Q.6 A group of student took an old shoe box and covered it with black paper from all side. They fixed a source of light (a torch) at one end of the box by making a hole in it and made another hole on the other side to view the light. They placed a milk sample contained in a beaker/ tumbler in the box milk taken in the tumbler was illuminated. They tried the same activity by taking a salt solution but found that light simply passed through it ?

(a) Explain why the milk sample was illuminated. Name the phenomenon involved.

(b) Same results were not observed with a salt solution. Explain.

(c) Can you suggest two more solution which would show the same effect as shown by the milk solution ?

Q.7 You are provided with a mixture containing sand, iron fillings ammonium chloride and sodium Chloride. Describe the procedures you would use to separate these constituents from the Mixture?

Q.8 What is meant by fractional distillation. How is it different from simple distillation. Give one Example of fractional distillation in industry.

Q.9 What is a colloidal solution ? Haw is it different from a true solution. Identify the colloidal solutions from the following :

Copper sulphate solution, vinegar, blue ink, milk of magnesia.

Q.10 A solution contains 110 g of sugar in 500 g of water. Calculate the concentration in terms of mass by mass percentage of the solution.

Q.11 Identify physical and chemical changes from the following :

Rusting of iron, cooking of food, freezing of water, burning of candle, melting of wax, glowing of a bulb.

Q.12 Distinguish between a mixture and a compound.

Q.13 (a) 4 g of solute dissolved in 36 g of water. What is the mass percentage of the solution ?

(b) How can we make a saturated solution, unsaturated ?

Q.14 Name the principle used to separate kerosene and water. Draw a neat and labelled diagram of the apparatus used in this separation.

Q. 15 (a) Name the technique that you will apply for the separation of the following

(i) Pigments from an extract of flower petals.

(ii) Cream from milk

(b) Mention any two differences between metals and non - metals

Q.16 Write two differences between colloids and the suspension on the basis of their characteristics. Identify the colloids from the following : Copper sulphate solution, milk, soluton of sugar and smoke

Q. 17 Give the difference between :

(a) a physical and a chemical change

(b) a homogeneous and a heterogeneous mixture

(c) a colloid and a true solution

Q.18 Which separation techniques will you apply for the separation of the following ?

(a) Mixture of iron and sulphur

(b) Camphor from the mixture of camphor and sodium chloride

(c) Different components of ink

Q.19 Mention the difference between true solution suspension and colloidal solution on the basis of filteration and stability.

Q.20 Define the terms solute, solvent and solution. When is a solution said to be saturated?

State two ways by which a saturated sugar solution can be made unsaturated.

EXERCISE – II OLYMPIAD QUESTIONS

Q.1 Milk is a _____ solution while vinegar is a _____ solution.

(A) suspension, colloidal

(B) colloidal, suspension

(C) true, colloidal

(D) colloidal, true

Q.2 A liquid and a solid together consisting a single phase is known as:

(A) solution (B) solute
(C) solvent (D) emulsion

Q.3 Which of the following is a homogeneous system?

(A) Muddy water

(B) Bread

(C) Concrete

(D) A solution of sugar in water

Q.4 The zig-zag movement of dispersed phase particle in a colloidal system is known as:

(A) transitional motion

(B) circular motion

(C) linear motion

(D) brownian motion

Q.5 An emulsion is a colloidal system of:

(A) solid dispersed in solid
(B) liquid dispersed in liquid
(C) gas dispersed in liquid
(D) liquid dispersed in solid

Q.6 Milk is :

(A) fat dispersed in water
(B) fat dispersed in milk
(C) fat dispersed in fat
(D) water dispersed in milk

Q.7 Scattering of light takes place in :

(A) electrolytic solutions

(B) colloidal solutions

(C) electrodialysis
(D) electroplating

Q.8 Foam is a colloidal solution of :

(A) gaseous particles dispersed in gas
(B) gaseous particles dispersed in liquid
(C) solid particles dispersed in liquid
(D) solid particles dispersed in gas

Q.9 Which of the following forms a colloidal solution in water?

(A) Salt (B) Glucose
(C) Starch (D) Barium nitrate

Q.10 Movement of colloidal particles under the influence of electrical field is called:

(A) electrophoresis (B) dialysis
(C) ionisation (D) electrodialysis

Q.11 Gelatin is also called as:

(A) protective colloid

(B) hydrophilic colloid

(C) emulsion

(D) none of these

Q.12 The sky looks blue due to :

(A) dispersion effect (B) reflection
(C) scattering (D) transmission

Q.13 In colloidal state, particle size ranges from:

(A) 1 to 10 A^0 (B) 20 to 50 A^0
(C) 10 to 100 A^0 (D) 1 to 280 A^0

Q.14 Tyndall effect is observed in:

(A) solution (B) precipitate
(C) sol (D) vapour

Q.15 Brownian movement is due to:

(A) temperature fluctuations within the liquid phase

(B) attraction and repulsion between the charges on the colloidal particles

(C) impact of molecules of the dispersion medium on the colloidal particles

(D) convention currents

Q.16 Difference between a crystalloid and a colloid is in :

(A) particle size
(B) the nature of solute
(C) diffusion through a membrane
(D) all of the above

Q.17 Blood is _____ charged sol.

(A) negatively (B) positively
(C) neutral (D) none of these

Q.18 Ice cream is an example of:

(A) true solution (B) emulsion
(C) colloid (D) suspension

Q.19 Water loving colloids are called:

(A) hydrophobic colloids
(B) reversible colloids
(C) irreversible colloids
(D) hydrophilic colloids

Q.20 The technique used in ultra microscope is:

(A) adsorption (B) coagulation
(C) Tyndall effect (D) electrophoresis

Q.21 Coagulation occurs due to:

(A) the scattering of light
(B) the presence of charges
(C) the neutralization of charges
(D) unequal bombardment by solvent molecules

Q.22 Sol is:

(A) solid dispersed in liquid
(B) liquid dispersed in gas
(C) gas dispersed in liquid
(D) gas dispersed in solid

Q.23 In both dialysis and osmosis which particles do not pass through the semi-permeable membrane?

(A) Water (B) Small molecules
(C) Colloids (D) All of these

Q.24 The separation of colloidal particles from those of molecular dimensions is called:

(A) dialysis (B) pyrolysis
(C) peptization (D) photolysis

Q.25 Electrophoresis is due to :

(A) the neutralization of charge
(B) the presence of charge
(C) the scattering light
(D) all of the above

Q.26 Adsorption property is applied in ;

(A) sewage disposal
(B) ultramicroscope
(C) smoke precipitator
(D) medicine

Q.27 Liquid dispersed in gas is called:

(A) aerosol (B) solid sol
(C) sol (D) solid foam

Q.28 Drinking soda is an example of 'a solution of:

(A) gas in liquid (B) liquid in gas
(C) gas in gas (D) soild in liquid

Q.29 Amalgam is a solution of:

(A) solid in solid (B) solid in liquid
(C) liquid in solid (D) liquid in liquid

Q.30 Which of the following is a true solution?

(A) NaCl in sulphur dioxide
(B) Copper in silver
(C) Salt in petrol
(D) Mud in water

Q.31 Which of the following statements is correct?

(A) Compounds can be separated into constitu ents by physical processes

(B) The boiling points and melting points of compounds are not fixed

(C) The composition of compounds are not fixed

(D) The properties of compounds are entirely different from those of its constituents

Q.32 Water is:

(A) a compound (B) a mixture
(C) true solution (D) all of these

Q.33 The material which contains at least two pure substances and shows the properties of their constituents is called:

(A) a compound (B) an element
(C) a mixture (D) a solution

Q.34 Select the odd one.

(A) Hydrogen (B) Oxygen
(C) Steam (D) Chlorine

Q.35 Milk of Magnesia is an example of:

(A) emulsion (B) true solution
(C) colloid (D) suspension

Q.36 A solution of iodine in carbon tetra - chloride is known as:

(A) aqueous solution
(B) alcoholic solution
(C) nonaqueous solution
(D) tincture of iodine

Q.37 Solid foam is:

(A) solid dispersed in solid
(B) liquid dispersed in solid
(C) gas dispersed in solid
(D) solid dispersed in liquid

Q.38 What is the property used in sewage disposal?

(A) Coagulation (B) Adsorption
(C) Electrophoresis (D) Tyndall effect

Q.39 Which of the following is a characteristic of both mixtures and compounds?

(A) They contain components in fixed proportions

(B) Their properties are the same as those of their components

(C) Their weight equals the sum of the weights of their components

(D) Energy is given out when they are being prepared

Q.40 When salt is dissolved in water, there is:

(A) an increase of boiling point

(B) no change in boiling point

(C) a decrease of boiling point

(D) none of the above

Q.41 How many grams of hydrochloric acid are formed when 2 grams of hydrogen combine with excess of chlorine?

(A) 35.5 gm (B) 36.5 gm
(C) 73 gm (D) 37.7 gm

Q.42 The size of a colloidal particle is :

(A) 10^{-1} to 10^{-3} cm (B) 10^{-5} to 10^{-7} cm
(C) 10^{-8} to 10^{-5} cm (D) 10^{-6} to 10^{-8} cm

Q.43 Which of the following is not a compound?

(A) Sugar (B) Common salt
(C) Diamond (D) Plaster of Paris

Q.44 Which of the following is an example of a mixture?

(A) Sugar (B) Brass
(C) CO_2 (D) $N0_2$

Q.45 Which of the following properties is different for solids, liquids and gases?

(A) Movement of molecules
(B) Particle size of the substance
(C) Mass of the substance
(D) Energy exchanges

Q.46 Sublimation of iodine, camphor and naphthalene is an example of:

(A) chemical change

(B) energy change

(C) physical change

(D) irreversible change

Q.47 Which of the following obey the law of constant proportions in their formation?

(A) Mixtures (B) Compounds.
(C) Elements (D) Colloids

Q.48 Which of the following is not a chemical change?

(A) Rusting of iron

(B) Converting water into steam
(C) Preparing curd from milk

(D) Burning of coal

Q.49 Burning of a candle is a/an :

(A) chemical change

(B) physical change

(C) energy change

(D) reversible change

Q.50 A chemical compound always consists of the same elements which combine in the same fixed ratio by weight', is the statement of :

(A) Law of definite proportions
(B) Gay-Lussac's law
(C) Law of multiple proportions
(D) None of these

Q.51 The most abundant metal in the earth's crust is:

(A) Fe (B) Cu
(C) Al (D) Au

Q.52 The number of nonmetallic elements which are liquids at room temperature is :

(A) 2 (B) l
(C) 4 (D) 3

Q.53 The most abundant element in the earth's crust is

(A) Si (B) C
(C) O (D) Ca

Q.54 Which of the following is expected to conduct electricity?

(A) Diamond (B) Molten sulphur
(C) Molten KCl (D) Crystalline NaCl

Q.55 Diamond is the strongest naturally occurring substance. Its hardness is due to:

(A) high solubility in water

(B) covalent bonds

(C) high electrical conductance
(D) high boiling point

Q.56 Which of the following is an insulator?

(A) Aluminium (B) Diamond
(C) Graphite (D) Silicon

Q.57 Paramagnetic substances are:

(A) strongly magnetic

(B) weakly magnetic

(C) nonmagnetic

(D) none of these

Q.58 Which of the following is not a compound-

(A) Common salt

(B) Water

(C) Iron fillings

(D) Copper sulphate

Q.59 Which of the following is not a mixture-

(A) Soil (B) Air
(C) Steam (D) Milk

Q.60 Brass contains -

(A) Gold and copper

(B) Copper and zinc

(C) Zinc and silver

(D) Copper and silver

Q.61 Which of the following is not a chemical change-

(A) Electrolysis of water

(B) Boiling of water

(C) Digestion of food

(D) Burning of magnesium ribbon in oxygen to form magnesium oxide.

Q.62 Which of the following is a liquid metal-

(A) Copper (B) Mercury
(C) Bromine (D) Silver

Q.63 Which of the following is not a pure substance-

(A) Mercury (B) Sugar
(C) Blood (D) Salt

Q.64 Which of the following can be classified as a 'Substance' -

(A) Milk (B) Sea-water
(C) Ice (D) Cast iron

Q.65 Which of the following gives a true solution in water-

(A) Starch (B) Sugar
(C) Chalk powder (D) Egg albumin

Q.66 Which of the following statements is not correct-

(A) A compound is a pure substance
(B) Compound is homogeneous in nature
(C) Compound always contains two or more elements

(D) Compound can be separated into constituent elements by some physical process.

Q.67 Which of the following statements is not true-

(A) True solutions are homogeneous in nature
(B) Suspensions are heterogeneous in nature
(C) Solute particles in a colloidal solution can be separated by filtration

(D) True solutions are transparent to light

Q.68 Which of the following is the second most abundant metal in the earth's crust ?

(A) Copper (B) Aluminium
(C) Iron (D) Zinc

Q.69 Which of the following will show Tyndall effect-

(A) Starch solution

(B) Sodium chloride solution

(C) Copper sulphate solution

(D) Sugar solution

Q.70 When a beam of light is passed through a true solution, it gets-

(A) Reflected

(B) Absorbed

(C) Scattered

(D) Path of light does not visible

Q.71 Camphor can be purified by-

(A) Distillation

(B) Filtration

(C) Sedimentation

(D) Sublimation

Q.72 Carbon burns in oxygen to form carbon dioxide. The properties of carbon dioxide are-

(A) Similar to oxygen

(B) Similar to carbon

(C) Totally different from both carbon and oxygen

(D) Much similar to both carbon and oxygen

Q.73 A mixture of common salt and water can be separated by-

(A) Sublimation

(B) Evaporation

(C) Separating funnel

(D) Filtration

Q.74 The process of cooling a hot, concentrated solution of a substance to obtain crystal is called -

(A) Fractional distillation

(B) Distillation

(C) Crystallisation

(D) Chromatography

Q.75 A solution in which more quantity of solute can be dissolved without raising its temperature is called -

(A) Unsaturated solution

(B) Saturated solution

(C) Super saturated solution

(D) Concentrate solution

Q.76 Colloidal particles can be normally seen by-

(A) Ordinary microscope

(B) Naked eye

(C) Electron microscope

(D) Telescope

Q.77 A mixture of alcohol and water can be separated by -

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(B) Fractional distillation

(C) Distillation

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Q.88 Which of the following is the second most abundant metal in the earth's crust ?

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Q.89 Which of the following will show Tyndall effect-

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(D) Sugar solution

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(D) Path of light does not visible

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Q.92 Carbon burns in oxygen to form carbon dioxide. The properties of carbon dioxide are-

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Q.93 A mixture of common salt and water can be separated by-

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(C) Separating funnel (D) Filtration

Q.94 The process of cooling a hot, concentrated solution of a substance to obtain crystal is called

(A) Fractional distillation

(B) Distillation

(C) Crystallisation

(D) Chromatography

Q.95 A solution in which more quantity of solute can be dissolved without raising its temperature is called -

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(C) Super saturated solution

(D) Concentrate solution

Q.96 Colloidal particles can be normally seen by-

(A) Ordinary microscope

(B) Naked eye

(C) Electron microscope

(D) Telescope

Q.97 A mixture of alcohol and water can be separated by -

(A) Separating funnel

(B) Fractional distillation

(C) Distillation (D) Crystallisation

Answers

1.	D	**2.**	A	**3.**	D	**4.**	D
5.	B	**6.**	A	**7.**	B	**8.**	B
9.	C	**10.**	A	**11.**	A	**12.**	C
13.	C	**14.**	C	**15.**	C	**16.**	D
17.	A	**18.**	B	**19.**	D	**20.**	C
21.	C	**22.**	A	**23.**	C	**24.**	A
25.	B	**26.**	D	**27.**	A	**28.**	A
29.	C	**30.**	B	**31.**	D	**32.**	A
33.	C	**34.**	C	**35.**	D	**36.**	C
37.	C	**38.**	A	**39.**	C	**40.**	A
41.	C	**42.**	B	**43.**	C	**44.**	B
45.	A	**46.**	C	**47.**	B	**48.**	B
49.	A	**50.**	A	**51.**	C	**52.**	A
53.	C	**54.**	C	**55.**	B	**56.**	B
57.	B	**58.**	C	**59.**	C	**60.**	B
61.	B	**62.**	B	**63.**	C	**64.**	C
65.	B	**66.**	D	**67.**	C	**68.**	C
69.	A	**70.**	D	**71.**	D	**72.**	C
73.	B	**74.**	C	**75.**	A	**76.**	C
77.	B	**78.**	C	**79.**	C	**80.**	B
81.	B	**82.**	B	**83.**	C	**84.**	C
85.	B	**86.**	D	**87.**	C	**88.**	C
89.	A	**90.**	D	**91.**	D	**92.**	C
93.	B	**94.**	C	**95.**	A	**96.**	C
97.	B						